Expositions, Museums, and Technological Display: Building Cultural Institutions for the "Inventor Citizen" in the Late Nineteenth Century United States

by

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ABSTRACT

The dissertation is an historical study of the interactions between technologists and museums in the late nineteenth United States, the role of international expositions–such as Philadelphia in 1876 and Chicago in 1893–in these interactions, and the rise of technology collections in those museums. Through archival sources, as well as published primary and secondary source material, the dissertation examines the role of engineers and the public in creating technological collections in museums dominated by natural history specimens. It focuses on intersections between industry, engineers, international expositions, and museums in the nineteenth century by considering the cases of the Smithsonian's National Museum and the Field Columbian Museum.

This research explores technology and its cultural roles, how technology related to or differed from other aspects of American culture, and how this may have precluded the establishment of a national museum dedicated to mechanical arts, technology and America's inventor citizens, even while some engineers brokered a place for technological collections to develop. Despite objections and a lack of support from the higher administration within the museums, mechanical and technological collections developed. In an era of enthusiasm for technology, invention, and mechanics, forces outside the museums pushed the development of the collections. In particular, a group of engineers, as curators and exhibit designers, played roles in the celebration of technological achievement and at the expositions, in the attempts to establish mechanical arts and technology collections at the two prominent museums, and in the connections between technologists and museums that proved essential to the development of the collections. In addition, pressure from a public audience enthused about technology and machines aided such collections by influencing museum administration.

This dissertation argues that engineers became mediators between the museum world and the world of engineering by brokering the culture of technology and securing a subordinate, yet permanent place for technology within the museum world. Key issues in the negotiation and brokering include the nature of the culture of technology, the professionalization process of engineers and their need for social status and cultural recognition, and the place of technology in nineteenth-century lives and hierarchies.

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On a more general note, the historian that I have become–and who wrote this dissertation–was built with the aid of many. Professors Smith, Graham, and Fitzgerald have set wonderful examples of what it means to "do" history, and I thank them. In addition, without the mentoring and friendship of Russ Zguta, I would never have gone this far. Without the challenge of Dr. Kenneth Moler, the writing would be much less readable.

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INTRODUCTION: Museums in "Technology's Nation"

By the late nineteenth century, the United States had become what historian of technology Thomas Hughes calls a "nation of machine makers and system builders" and "technology's nation."[1] At the opening of the 1876 Centennial Exposition in Philadelphia, President Grant and the Brazilian Emperor each grasped a lever on the giant Corliss engine that was to power the exhibits. The inventor, George Corliss, gave a signal to admit the steam to the giant machine's cylinders. *Scientific American* declared that "it was a scene to be remembered; and perhaps for the first time in the history of mankind, two of the greatest rulers in the world obeyed the order of an inventor citizen."[2] The *London Times* in 1878 stated that "the New Englander mechanizes as an Old Greek sculptured, as the Venetian painted or the modern Italian sings; a school has grown up whose dominant quality, curiously intense, wide spread, and daring, is mechanical imagination."[3] In the nineteenth century, while the European artists had museums, the American inventor citizens and engineers did not. Despite objections and a lack of support from the higher administration within the museums, mechanical and technological collections nonetheless began to develop. In an era of enthusiasm for technology, invention, and mechanics–a technological cultural milieu–forces outside the museums pushed the development of the collections. A small group of engineers brokered a place for technology within the museum world–a subordinate, to be sure, yet permanent place nonetheless.

At the same time that United States' citizens embraced mechanization and industrialization, they also were building permanent cultural institutions, such as libraries, universities, and museums. Yet, interestingly, America built no permanent national cultural institutions dedicated to

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[1]Thomas Parke Hughes, *American Genesis: A Century of Invention and Technological Enthusiasm 1870-1970* (New York, NY: Viking, 1989), 1, 2. For a discussion of the development and importance of America's "technological age," see also Melvin Kranzberg and Carroll W. Pursell, Jr., "The Importance of Technology in Human Affairs," in *Technology in Western Civilization*, Vol. 1, *The Emergence of Modern Industrial Society, Earliest Times to 1900* (New York, NY: Oxford University Press, 1967), 3-10.

[2]"The Opening of the Centennial," *Scientific American* (May 27, 1876): 337.

[3]Quoted in Robert C. Post, ed., *A Treatise upon Selected Aspects of the Great International Exhibition held in Philadelphia on the Occasion of Our Nation's One-Hundredth Birthday* (Washington, DC: National Museum of History and Technology, Smithsonian Institution, 1976), 23.

those "inventor citizens" and "machine builders" so central to the nation. 1870 marked the beginning of a century of technological enthusiasm in the United States; the world's fairs and international expositions touted and celebrated technology and invention. Yet, the United States established a national museum to commemorate its inventors, mechanics and engineers only in the latter half of the twentieth century when technological enthusiasm was fading.[4] Even the important Museum of Science and Industry in Chicago did not begin until the 1930s.

This dissertation focuses on intersections between industry, engineers, international expositions, and museums in the nineteenth century. The central figures, institutions and events include John Elfreth Watkins, George Colton Maynard, Joseph Gladding Pangborn, the Pennsylvania Railroad Company, the Centennial Exposition in Philadelphia in 1876, the United States National Museum (USNM, now part of the Smithsonian Institution), the World's Columbian Exposition in Chicago in 1893, and the Field Columbian Museum (now the Field Museum of Natural History) in Chicago. J. Elfreth Watkins (1852-1903), as engineer, curator and exhibit designer, connects these institutions and events by playing roles in the celebration of technological achievement at the expositions, in the attempts to establish mechanical arts and technology collections at the two prominent museums, and in the connections between technologists and museums that proved essential to the development of the collections. George C. Maynard (1838-1918), an electrical engineer, followed in Watkins' footsteps at the USNM and added electricity and engineering collections to Watkins' transportation and mechanical ones. Joseph G. Pangborn (1844-1914) attempted to build a railway and transportation collection at the Field Columbian Museum. While Pangborn worked as a railway official at the Baltimore and Ohio Railroad, he was not a practicing engineer. He ultimately failed in his efforts at the Field Museum. This dissertation explores technology and its cultural roles, how technology related to or differed from other aspects of American culture, and how this may have precluded the establishment of a

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[4]A Museum of History and Technology was established as a separate part of the Smithsonian Institution in the 1950s and opened to the public in 1964. See Hughes, *American Genesis,* for an extended and detailed discussion of technological enthusiasm from 1870-1970. For a discussion of the Museum of History and Technology, see Marilyn Sara Cohen, "American Civilization in Three Dimensions: The Evolution of the Museum of History and Technology of the Smithsonian Institution," Ph.D. Dissertation, George Washington University, 1980.

national museum dedicated to mechanical arts, technology and America's inventor citizens, even while some engineers brokered a place for technological collections to develop.

Historian Michael Smith observes that "more than any other institution, advertising by the mid-twentieth century had assembled and reshaped the images through which all mass depictions of technology gained public recognition." He argues further that "technological display developed through advertisements provided the only non-military view of technology and its social uses that remained available to a mass audience."[5] However, science and technology museums and centers after World War II also provided a view of technology and its social uses to mass audiences. Museums in the 1980s and 1990s have often become the center of controversies surrounding technological displays and social implications. These controversies and debates center on the proper role and function of a museum, particularly a "national" one. The story of the development of technological display in museums sheds light on the contentious evolution of museum roles in American society.

The interpretive framework of this dissertation follows recent trends in the historiography of museum history, exemplified by the work of Joel J. Orosz and others, and places the institutions, persons and events in the social, cultural and political context of the period.[6] Most of museum history research, however, focuses only on art museums, general history museums, or science and natural history museums. Orosz argues that by the 1840s, a group of scientists, to establish their own legitimacy and to separate themselves from amateurs, demanded changes in the old cultural institutions and aided in the development of new ones. Groups calling for popular education rose to oppose the agenda of these new professionals. According to Orosz, debates

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[5]Michael Smith, "Selling the Moon: The U. S. Manned Space Program and the Triumph of Commodity Scientism," in *The Culture of Consumption: Critical Essays in American History, 1880-1980,* ed. Richard Wightman Fox and T. Jackson Lears, 175-236 (New York, NY: Pantheon Books, 1983), 183.

[6]For example, see Joel J. Orosz, *Curators and Culture: The Museum Movement in America, 1740-1870* (Tuscaloosa, AL: University of Alabama Press, 1990); Mary P. Winsor, *Reading the Shape of Nature: Comparative Zoology at the Agassiz Museum* (Chicago, IL: University of Chicago Press, 1991), and Susan Sheets-Pyenson, *Cathedrals of Science: The Development of Colonial Natural History Museums during the Late Nineteenth Century* (Montreal, Quebec: McGill-Queen's University Press, 1988). See also Robert Bud, "Science, Meaning, and Myth in the Museum," *Public Understanding of Science* 4 (January 1995): 1-16; Brigitte Schroeder-Gudehus, "Patrons and Publics: Museums as Historical Artefacts," *History and Technology* 10 (1993): 1-3; Eilean Hooper-Greenhill, *Museums and the Shaping of Knowledge* (London, UK: Routledge, Chapman & Hall, 1992); and Sharon Macdonald, "Science on Display: The Representation of Scientific Controversy in Museum Exhibitions," *Public Understanding of Science* 1 (January 1992): 69-87.

resulted in the "American compromise"–a synthesis of professional science and popular education. However, this dissertation shows that the very presence and power of those scientists within these institutions and their views of technology and the mechanical arts made the development of technological collections far different from the sometimes closely related areas of science. Museum professionals consistently subordinated technology and invention under the "higher" disciplines of science, such as anthropology, ethnology and natural history, often calling it only applied science. Engineers had not yet achieved the level of professionalization of scientists, and they did not form part of the cultural elite. As the engineers professionalized and attempted to gain social and cultural status, they entered the museum world. Some engineers played key roles in establishing technology collections within museums. In addition, some engineers outside the museum actively promoted the preservation of engineering and technology artifacts. Their efforts had a large impact on the National Museum's technology collections, particularly during the early years. Nonetheless, the technologists had to fight continually against their subordinate position as those who merely applied science.

The Smithsonian Institution was founded in 1846 with a bequest from James Smithson as "an establishment for the increase and diffusion of knowledge among men." The areas of knowledge identified in the congressional act providing for the institution's foundation included natural history, geology, mineralogy, and chemistry. The institution would encompass a chemical laboratory, a library, a gallery of art, lecture rooms, and "cabinets" of "all objects of art and of foreign and curious research, and all objects of natural history, plants, and geological and mineralogical specimens, belonging, or hereafter to belong, to the United States."[7] The act did not mention technological or mechanical artifacts.

In his 1847 program for the new institution's organization, Joseph Henry (1797-1878), the Smithsonian's first Secretary, wrote that "the will [of James Smithson] makes no restriction in

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[7]"An Act to Establish the 'Smithsonian Institution,' for the Increase and Diffusion of Knowledge Among Men," in Paul H. Oehser, *The Smithsonian Institution,* 2nd ed. (Boulder, CO: Westview Press, 1983), 201, 204.

favor of any particular kind of knowledge; hence all branches are entitled to a share of attention."[8] However, Henry clearly wanted the Smithsonian to have more of a global than a national orientation and wanted the priority on research and publication, not collections and the museum. In 1850, Henry appointed Spencer Fullerton Baird (1823-1887), a natural historian, as director of the USNM. Baird, ironically, used his position to build up the museum collection and established the USNM as a distinct entity within the Smithsonian Institution. That entity focused clearly on natural history and related sciences. Both Henry and Baird were scientists, not engineers or inventors.

USNM staff collected some objects dedicated to technology, invention and mechanics, but they collected these artifacts without a goal or plan to preserve objects with reference to elaborating the history of technology. From its opening in 1881, the Smithsonian's Arts and Industries Building served as the main building for housing the museum collection. The name reflected the attempt by some Smithsonian officials to expand the museum's focus to include large artifact collections representing the new arts and industries of the nineteenth century. In 1911, the natural history collections, the mainstay of the nineteenth-century collections, which had been crowded in the Arts and Industries Building, moved to expansive quarters across the mall in the new Museum of Natural History building. The collections from aeronautics, engineering, crafts and industries, medicine and public health, photography and history remained behind in inadequate exhibit spaces.[9] Where did they come from if the Smithsonian notion of "knowledge" did not include technology?

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[8]"Joseph Henry's 'Programme of Organization' for the Smithsonian Institution," in Oehser, *The Smithsonian Institution,* 2nd ed., 207. For detailed information on Henry and his career, see Albert E. Moyer, *Joseph Henry, The Rise of an American Scientist* (Washington, DC: Smithsonian Institution Press, 1997); Leonard Carmichael, *Joseph Henry (1797-1878) and His Smithsonian Institution* (New York, NY: The Newcomen Society in North America, 1956); Nathan Reingold, ed., *The Papers of Joseph Henry* (Washington, DC: Smithsonian Institution Press, 1972-1992); Patricia Jahns, *Matthew Fontaine Maury and Joseph Henry, Scientists of the Civil War* (New York, NY: Hastings House, 1961); Arthur P. Molella and Nathan Reingold, "Theorists and Ingenious Mechanics : Joseph Henry Defines Science," *Science Studies* 3 (1973): 323-351; and Arthur P. Molella, ed., *A Scientist in American Life; Essays and Lectures of Joseph Henry* (Washington, DC: Smithsonian Institution Press, 1980).

[9]See Monro MacCloskey, *Our National Attic: The Library of Congress, the Smithsonian Institution, and the National Archives* (New York, NY: R. Rosen Press, 1968), 160. By the 1960s, these collections formed the basis of the newly named National Museum of History and Technology.

Research on the Smithsonian Institution in the nineteenth century has documented the institution's activities that led to most of the natural history and ethnological (later anthropological) collections. Scholars, such as Robert Rydell and Curtis Hinsley, have analyzed the sources and impact of these collections, and nineteenth-century world's fairs and expositions proved to be one of the major sources of collections–as well as of certain attitudes, symbolism and techniques connected with them. Smithsonian scientists and curators formed the anthropological and natural history collections with specific intents, and the nineteenth-century Smithsonian maintained those collections as the priority ones.[10] The technological collections "slipped in the back door," through the mediation and negotiation of a few "engineer-curators."[11]

Sources for the natural history and anthropological collections proved to be various. Some Secretaries and Assistant Secretaries of the Institution, mainly scientists, brought personal collections with them. The US Government funded and led expeditions to the western United States and to other parts of the world, often with the assistance of the Smithsonian's experts. Specimens collected on these expeditions added to the natural history collections through samples of flora and fauna as well as cultural artifacts and descriptions of language, dress and customs. The world's fairs also contributed to these Smithsonian collections. Smithsonian personnel created or assisted with the development of several large and elaborate anthropological exhibits at many world's fairs. These personnel often oversaw the transplantation of the fair exhibits to a permanent home at the Smithsonian Institution or other museums. Rydell and Hinsley also reveal the close connections in the late nineteenth century among museums, the world's fairs, and the new discipline of anthropology. The "symbolic universe" described by Rydell and created by those working in and around these institutions contained certain attitudes that influenced the scientific community in the United States, in which the Smithsonian played a key role. The museums, the fairs, and anthropology connected through the personnel, the objects, the display techniques, and

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[10]See Robert W. Rydell, *All the World's a Fair: Visions of Empire at American International Expositions, 1876-1916* (Chicago, IL: University of Chicago Press, 1984), and Curtis M. Hinsley, *Savages and Scientists. The Smithsonian Institution and the Development of American Anthropology, 1846-1910* (Washington, DC: Smithsonian Institution Press, 1981).

[11]For the use of the term engineer-curator, see Arthur P. Molella, "The Museum That Might Have Been, The Smithsonian's National Museum of Engineering and Industry," *Technology and Culture* 32 (1991): 237-263.

even the buildings.[12] For example, the Smithsonian Institution specifically built the Arts and Industries Building to house the collections (mostly anthropology and natural history) received from the 1876 Philadelphia Exposition. Ironically, while George Corliss's giant steam engine, used to run machinery in Machinery Hall, proved to be the most visible display at the Exposition, it and machines like it did not follow the anthropology objects into permanent Smithsonian displays.[13]

Several possibilities exist for identifying the main sources for technological display in the late nineteenth century at the USNM and the Field Columbian Museum in Chicago. Surprisingly, only a few of the USNM technological collections came directly from the fairs. More often, the artifacts and displays from fairs went back to the companies who built them and only came to the museum years later. In other cases, the USNM staff used governmental funds set aside for specific fairs to obtain or build technological items for display. Some inventors and entrepreneurs also donated objects and collections without ever displaying them at fairs.

The objects themselves carried their own influence because of what they symbolized to most of a US society forged in the industrial revolution. In historian David Nye's view, many of these technological objects fused "practical goals with political and spiritual regeneration"; Americans elevated the symbolic role of technology above its function. Nye argues that "since the early nineteenth century the technological sublime has been one of America's central 'ideas about itself'–a defining ideal, helping to bind together a multicultural society."[14] Historian Brooke Hindle argues for the importance of "man's need to touch the past," and relics prove to be the best physical connection to a collective national memory. Objects can give scholars and museum

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[12]For a discussion of the role of the Smithsonian in the "symbolic universe" of the nineteenth century culture and world's fairs, see Robert Rydell, *All the World's a Fair* (Chicago, IL: University of Chicago Press, 1984). For discussion of symbolism of Smithsonian Institution buildings along the Mall and the connections of these to the world's fairs and international expositions, see MacCloskey, *Our National Attic,* Kenneth Hafertepe, *America's Castle: The Evolution of the Smithsonian Building and Its Institution, 1840-1878* (Washington, DC: Smithsonian Institution Press, 1984), and Smithsonian Institution, *The Smithsonian Experience, Science, History, the Arts. the Treasures of the Nation* (Washington, DC: The Smithsonian Institution, 1977).

[13]The Corliss engine and its significance will be discussed below in Chapter 2. For additional information, also see John Kasson, *Civilizing the Machine: Technology and Republican Values in America, 1776-1900* (New York, NY: Grossman Publishers, 1976) and William Dean Howells, "A Sennight of the Centennial," *Atlantic Monthly* (July 1876): 92-107.

[14]David E. Nye, *American Technological Sublime* (Cambridge, MA: MIT Press, 1994), xx, xiii.

visitors information that words alone cannot.[15] However, if nineteenth-century Americans truly invested technological artifacts with this sublimity, it seems logical that, as cultural symbols, they would fit naturally within a museum setting. Americans would celebrate and display these objects reverently as important national relics. The *John Bull* locomotive, the first steam locomotive to run in the United States, served as such a symbol of America. The *John Bull* became the first registered accession for the transportation collections at the USNM; the Pennsylvania Railroad Company donated it in the mid-1880s. It was prominent at the 1876 and 1893 fairs, and it remains a centerpiece in the Smithsonian's National Museum of American History today.

The early staff at the Smithsonian consisted mainly of scientists–including natural scientists, ethnographers, ornithologists, physicists, and chemists–not engineers, mechanics, or craftsmen. The US Patent Office added a collection to the USNM in 1857, but these collections consisted of natural history specimens gathered on US Government exploring expeditions.[16] USNM staff added assorted industrial and craft items to the collections as part of the anthropological exhibits. Smithsonian scientists brought carts, baskets, tools for fishing and hunting, and other items of daily use by various peoples into the collections as ethnological artifacts. The institution also received some artifacts in the numerous railway cars of specimens from Philadelphia in 1876; but, again, they consisted more of ethnological rather than technological items.[17] The distinction lay in the views of Smithsonian scientists and curators. In their opinion, artifacts and tools from so-called "primitive" cultures–the interest of anthropology and ethnology–could not be technology because technology equated with civilization and progress. Yet, modern technology did not equate with civilization enough for scientists and curators to include it in the cultural institutions of civilization, that is, its museums.

George Brown Goode (1851-1896), an ichthyologist who became Assistant Director of the National Museum in 1880, attempted to gather some technological artifacts and arrange and collect

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[15]See Brooke Hindle, "How Much Is a Piece of the True Cross Worth," in Ian M. G. Quimby, ed., *Material Culture and the Study of American Life* (New York, NY: W. W. Norton, 1978), 5-20.

[16]In 1908, the US Patent Office did finally give a large series of patent models and machines to the USNM. See Chapter 6 below for details.

[17]The number of actual carloads transported to the USNM varies in reports from 42 to 84.

them with a central principle in mind–the "needs of man." He wanted to illustrate "human culture and industry in all its phases."[18] Historian Arthur Molella believes that Goode saw the technological artifacts as "the basis for instructional exhibits on the role of technology in modern society."[19] Moreover, he wanted to develop specific technological departments at the Smithsonian. In 1881, with Secretary Baird's blessings, he established a Department of Arts and Industries (DAI) with himself as curator. By 1885 it included sections on materia medica, fisheries, textiles, industries, naval architecture, foods, animal products, historical relics, and transportation. The USNM assigned a special catalog to the Section on Transportation and Engineering with the first entry, the Pennsylvania Railroad Company's donation of the locomotive *John Bull,* dated March 10, 1885.[20] Yet, Goode placed these technological artifacts within his overall vision of anthropology. The Smithsonian and its staff did not collect technology for its own sake or for its central role in American culture, society and history.

In 1885, with George Brown Goode's support, John Elfreth Watkins (1852-1903), an engineer with the Pennsylvania Railroad, became an honorary curator of transportation at the USNM. Goode proposed a national museum of industry and engineering in the 1890s, although the Smithsonian never acted upon his suggestion.[21] Engineers, particularly railroad ones, and engineering societies, such as the American Society of Civil Engineers (ASCE), supported Watkins' and Goode's efforts. They wrote letters of support to the US Congress and donated artifacts. In addition, through resolutions at annual meetings, the societies encouraged their members to aid the efforts with donations and moral support.

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[18]George Brown Goode, "Report of the Assistant Director of the United States National Museum, for the Year 1881," *Annual Report of the Board of Regents of the Smithsonian Institution, 1881* (hereafter cited as *Annual Report, Smithsonian Institution)* (Washington, DC: Government Printing Office, 1882), 89.

[19]Arthur Molella, "The Museum That Might Have Been," 240.

[20]George Brown Goode, "Report upon the Condition and Progress of the U. S. National Museum during the fiscal year ending June 30, 1889," *Report of the U. S. National Museum, under the direction of the Smithsonian Institution for the Year Ending June 30, 1889, Annual Report of the Board of Regents of the Smithsonian Institution* (hereafter cited as *USNM Report)* (Washington, DC: Government Printing Office, 1890), 21. The *John Bull* was the oldest complete locomotive in America. It had been ordered by George and Robert Stephenson in 1830 and had been put into service in 1831.

[21]Charles D. Walcott, "Report upon the Condition and Progress of the U. S. National Museum during the year ending June 30, 1897," *USNM Report, 1897,* 213.

From 1886 to 1892, Watkins worked diligently to build the technological collections at the USNM, acting as an "engineer-curator." Watkins' goals at the USNM included a general view of the development of technology, especially mechanical technology. For example, he wanted a collection that would illustrate the history of the development of the bicycle, and, by 1890, he had secured the nucleus of such a collection.[22] The museum also had the nuclei of other series illustrating the history of the stationary steam engine, the steamboat, the locomotive, and the electric telegraph. In 1891, Watkins wrote that he hoped "eventually to secure a series of objects to illustrate the birth and development of the mechanic arts, with special reference to the evolution of epoch-making inventions." He aimed not only for the history of invention, but for "ascertaining the influence that inventive action has had upon the occupations, habits, and customs of the human race."[23] Molella has argued that Watkins was an early historian of technology. This dissertation argues further that Watkins worked at a key period when engineers were just beginning to establish a professional identity and that entering the museum world was a part of the process. Watkins' connections to the engineering ranks outside the museum proved to be essential.

While Watkins worked at the Smithsonian, he maintained strong engineering connections from his time as a professional engineer and these connections aided the development of the USNM technology collections. Major contributors, for example, included Watkins' former employer, the Pennsylvania Railroad Company. By 1889, Watkins' section on transportation and engineering numbered 125 entries in the museum catalogue. However, Goode stated that "in this section the work of cataloguing has never been carried on systematically, owing to the pressure of other work." Watkins, in 1890, complained that he did the routine work of the Section of Transportation and Engineering "at such times as [his] duties in the Department of Property and Supplies would permit." By 1891, the report listed Watkins as "Engineer of Property" under clerical staff, not under the Curatorial staff section. However, he still wrote the "Report on the

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[22]Watkins, "Report on the Section of Transportation and Engineering in the U. S. National Museum, 1890," *USNM Report, 1890,* 159.

[23]Watkins, "Report on the Section of Transportation and Engineering in the U. S. National Museum, 1891," *USNM Report, 1891,* 163.

Section of Transportation and Engineering in the US National Museum, 1891" in the same report.[24] Engineering technology still remained peripheral to the Smithsonian's interests.

Watkins left the USNM in 1892 to return to work for the Pennsylvania Railroad Company. He designed their exhibit for the 1893 Columbian Exposition in Chicago, which centered on the locomotive *John Bull,* previously on display at the USNM. Since most of the exhibit tied everything to the Pennsylvania Railroad Company, it failed to meet Watkins' vision of a more general history of development in particular fields (such as transportation or mechanics).

When the 1893 Exposition closed, Watkins took charge of the new Department of Industrial Arts (DIA) at Chicago's Field Columbian Museum–a direct outgrowth from the 1893 fair.[25] The museum opened in June 1894. The collections of the DIA came from European (particularly British and Irish) and American manufacturers, some of which had exhibits at the Chicago exposition. At the Field Museum, Joseph G. Pangborn (1844-1914), a Baltimore and Ohio Railroad employee, assisted Watkins with the transportation and railway collections. While Watkins left the Field Museum to return to the Smithsonian in 1895, the DIA grew. By October 1, 1896, the DIA registered a total of 13,600 items in the museum catalogue– more than any other department. Yet, in 1897, the museum abolished the DIA and moved the collections to the Department of Anthropology or disbursed them.[26]

Back at the Smithsonian as Curator of Mechanical Technology, Watkins finally received some assistance in the form of George C. Maynard (1838-1918), an electrical engineer and secretary of the Telegraphic Historical Society of North America and the American Association of Inventors and Manufacturers. Maynard joined the USNM staff in 1896 as Custodian of Electrical

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[24]See Goode, "Report upon the Condition and Progress of the U. S. National Museum during the fiscal year ending June 30, 1889," *USNM Report, 1889,* 21; Watkins, "Report on the Section of Transportation and Engineering in the U. S. National Museum, 1890," *USNM Report, 1890,* 159; Goode, "Report upon the Condition and Progress of the U. S. National Museum during the year ending June 30, 1891," *USNM Report, 1891,* 22-23, and Watkins, "Report on the Section of Transportation and Engineering in the U. S. National Museum, 1891," *USNM Report, 1891,* 163-70.

[25]The state of Illinois had originally incorporated the museum as the Columbian Museum of Chicago, but the name was officially changed to the Field Columbian Museum in June 1894, less than a month after opening its doors, due to a large monetary donation from Marshall Field.

[26]Field Columbian Museum, *Annual Report of the Director to the Board of Trustees for the Year 1894-1895* (hereafter cited as *Field Museum Annual Report)* (Chicago, IL: The Museum, 1895), 16; *Field Museum Annual Report, 1894-95,* 30. See Chapter 5 below for details.

Collections. Just as Watkins had been a way into the museum for the forces within the railroad and civil engineering groups outside the museum, Maynard became a way in for those in the electrical and telegraph fields.

After Watkins returned to the National Museum, the Smithsonian's Department of Arts and Industries suffered the same fate as the Department of Industrial Arts at the Field Museum; museum administration removed the department from the institutional organizational charts in 1897. Watkins then headed the Section of Technology, which was placed administratively in the Anthropology department. He held this position in addition to his job as Superintendent of Buildings at the USNM. Watkins, after more than ten years, still spent only a part of his time on his curatorial duties regarding the technology collections. Despite this lack of time and the lack of administrative support, Watkins, Maynard, and forces outside the museum managed to negotiate enough of a place for a collection that it now held a permanent, if subordinate, place at the institution. In the last decade of the nineteenth century, the technological and mechanical collections at the USNM continued to grow, but they existed far from center stage and the staff collected them without a philosophy or guiding principles. Technology simply slipped in the back door.

The concepts of technology and technologist are key to this study. Several historians and scholars have attempted to define technology, often as "machines" or "processes" or "systems."[27] Technology, in the context of this dissertation, refers to machines, civil engineering structures, and mechanical technology. The term technologists includes inventors, artisans, mechanics, and engineers. In the mid-nineteenth century, the characters in this study rarely used the term "technology" or "technological"; they more often used phrases such as mechanical arts or useful and practical arts. By the turn of the century, however, the term technology frequently appeared in

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[27]For example, historian Howard Segal defined technology as follows. "The elements of technology included numerous materials, both natural and man-made . . . equally numerous machines and structures . . . ; the processes of discovering or inventing and refining and producing all of those materials and machines and structures; the technical knowledge, skills and equipment needed to carry out all of those processes; and the history of the development of all of those processes and techniques." [Howard Segal, *Technological Utopianism in American Thought* (Chicago, IL: University of Chicago Press, 1985), 80-1.] According to David Nye, in the nineteenth century, technology was "machines, patents, and systems of production." [Nye, *American Technological Sublime*, 45-6.]

their writings. In both cases, the writers and speakers referred to similar areas of endeavor and similar objects, but the words carried some different meanings. The words mechanic arts and mechanic brought to mind dirty hands, vulgarity, and haphazard, trial-and-error methods by social inferiors. Technology and the engineer soon brought to mind a more intellectual endeavor, with educated technicians in clean settings.[28] Not coincidentally, this evolution in language during the latter half of the nineteenth century paralleled the arrival of the technology collections in the museums. During this time period, much of the American public also experienced technology as synonymous with machines, such as steam engines and locomotives, and the history of technology as based on a chronology of inventors and devices.[29] The focus for this study, as well as for J. Elfreth Watkins, centers on the objects that epitomized a mechanized America.

Several important themes emerge in this study of the attempts to establish a national museum or even a national collection intentionally devoted to engineering, invention, and technology. In the nineteenth century, the machines, mechanics, and inventors played cultural roles. American culture consisted of knowledge and values shared by American society. Machines, such as the power loom and the locomotive, symbolized American culture and became entangled with values and knowledge.[30] Thus, machines, as cultural artifacts, should fit well into museum settings. In the nineteenth century, they do not. Moreover, nineteenth-century

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[28]For a detailed discussion of the development and use of the term technology, see Leo Marx, "Technology: The Emergence of a Hazardous Concept," *Social Research* 64 (Fall 1997): 965-988.

[29]For a discussion of the popular view of and reaction to technology in nineteenth-century America, see Melvin Kranzberg and Carroll Pursell, Jr., "The Importance of Technology in Human Affairs," and Charles Sanford, "Technology and Culture at the End of the Nineteenth Century: The Will to Power," in Kranzberg and Pursell, *Technology in Western Civilization*, 726-739. According to Sanford, "The machine was the master image of the day, whether expressed in metaphor and symbol or in the outpouring of new engineering marvels and the daily, familiar sight of factories, streetcars, steamships, locomotives, hydraulic pumps, dynamos, reapers, binders, elevators, printing presses, electrical appliance, sewing machines, telephones, and the machine tools and dies which stamped them out with uniform precision in prodigious number (726)."

[30]For discussions of machines as cultural and political forces and artifacts, see Steve Lubar, "Machine Politics: The Political Construction of Technological Artifact," in Steven Lubar and W. David Kingery, *History from Things, Essays on Material Culture* (Washington, DC: Smithsonian Institution Press, 1993); Raymond H. Merritt, *Engineering in American Society, 1850-1875* (Lexington, KY: University Press of Kentucky, 1969), 1-3; and Langdon Winner, "Do Artifacts Have Politics?" *Daedalus* 109 (1980): 121-36. According to Lubar, "machines "define life, constrain it, focus energies, and thus structure possibilities (198)." Lubar suggests that machines "partake enough of culture and politics to allow them to be lined up and categorized with other cultural and political artifacts (205)," and technology "is the physical embodiment of social order, reflecting cultural traditions. It is part of culture, and as such it mediates social relationships (207)." See also Brooke Hindle, "How Much is a Piece of the True Cross Worth," for a discussion of the importance of preserving artifacts as material culture.

technology in America conveyed a sense of progress, constant motion, and transition. Novelty, dynamism, and moving machine parts epitomized the growing and changing American nation.[31] These characteristics of machines and invention made it difficult for them to fit into static museum settings. Machines and inventions fit more naturally into the transient setting of the world's fairs than the static one of the museums.

An historical view of technology as different from–and often below–science also emerges in this study. The Smithsonian Institution's founding mission focused on the "increase and diffusion of knowledge." However, did technology and invention constitute forms of knowledge worth increasing, diffusing and preserving in the same way as science? Most early curatorial staff at the Smithsonian were scientists who did not view technology as an aspect of knowledge on the same level as scientific achievements. Nonetheless, many historians have subsequently grouped technology collections together with science collections and conclude that what held for science, held for technology. Scientists worked both in museums and at the fairs, and they influenced anthropology and natural history displays at both. Technologists, by contrast, did not. Participants in technological displays at world's fairs were engineers, technicians, mechanics and inventors, yet these participants had few linkages to the full-time curatorial staff at the museums. Given this situation, Watkins and Maynard became mediators between the museum world and the world of engineering.

This dissertation rejects some misinterpretations of the nexus at which culture (in the form of museums), engineers and their professionalization, and the public enthusiasm for machines and technology met. In his work on technological collections at the Smithsonian, Arthur Molella focuses on more modern issues in the history of technology (for example, "progress talk" and internalist versus externalist approaches). In doing so, he views Watkins and Maynard as curators and historians, but, as I see them, they were first and foremost, engineers and technologists.

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[31]Historian David Nye describes certain technologies, particularly the railroad, as the "dynamic sublime." [Nye, *American Technological Sublime*, 45.] According to Alan Trachtenberg, "machines were working parts of a dynamic system." [Alan Trachtenberg, *The Incorporation of America, Culture and Society in the Gilded Age* (New York, NY: Hill and Wang, 1982), 55.]

While Watkins served as curator and historian, he remained primarily an engineer, and his status in the engineering community continued to concern him. While the subordination of Watkins' work within Anthropology, according to Molella, may have given him a "broad social and cultural understanding of technology," it hurt his real aims: the development of a strong collection dedicated to transportation and technology at a major US museum.[32] In addition, as an engineer, Watkins played a part in the professionalization process of the engineering field. Part of that process included distinguishing the practice of engineering from other areas of knowledge, such as the physical sciences and anthropology. Watkins believed that such efforts had thus far failed. The attitudes prevalent at the late-nineteenth-century international expositions had not transferred to the permanent setting of the elite cultural museum world. Technology and machines were not celebrated but were tolerated. Thus, the accepted connection between international exhibitions and technology museum collections does not appear as clear and direct as in the work of Eugene S. Ferguson, Bernard S. Finn, Robert Rydell, and Paul Greenhalgh.[33] One problem seems to be lumping together science (for example, natural history, ethnology, and anthropology) museums and technology museums as if they embraced a single enterprise. Another problem centers on the lumping of the relationship between technological museum collections and international exhibitions with the relationship between major museum work and international expositions. Anthropology and natural history were present at the expositions, but they were not central to them; anthropology and natural history *were* central to nineteenth-century museums. Philadelphia, Chicago, and other expositions centered on machines and technology; museums did not.

In the history of technology and the history of engineering, a trend toward "externalist" or "contextualist" history has developed. This history includes not only the machines and artifacts, but also the people, values, symbols, organizations and systems that surround the creation and use

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[32]Molella, "The Museum That Might Have Been," 264.

[33]See Eugene S. Ferguson, "Technical Museums and International Exhibitions," *Technology and Culture* 6 (1965): 30-46; Bernard S. Finn, "The Museum of Science and Technology," in *The Museum: A Reference Guide*, ed. Michael Steven Shapiro with the assistance of Louis Ward Kemp, 59-83 (Westport, CT: Greenwood Press, 1990); Finn, "The Science Museum Today," *Technology and Culture* 6 (1965): 74-82; Robert Rydell, *All the World's a Fair*; Paul Greenhalgh, "Education, Entertainment and Politics: Lessons from the Great International Exhibitions," in *The New Museology*, ed. Peter Vergo, 74-98 (London, UK: Reaktion Books Ltd., 1989).

of the objects. A set of organizations often left out of the "technological system" is the cultural ones, particularly museums.[34]

Joel J. Orosz, writing from the perspective of museum history, observes that the institutional formation of the "American" museum–as an "institution which simultaneously provides popular education and promotes scholarly research was completely developed"–appeared complete by 1870.[35] However, this view misses the point that an ongoing struggle existed to establish technology collections. Orosz focuses on two groups in the museum world, those wanting research and those wanting popular education and displays. A third group, the public and their interests, are left out of Orosz's description. According to this dissertation, the cultural imperatives felt by the public also played a role in the determination of the museum missions. In essence, the public view of technology in the nineteenth century helped define the early history of technology through their role in driving the development of technology collections in museums. These collections, and the curators caring for them, provided a seedbed for the development of a distinct field of study in the history of technology in the latter half of the twentieth century.[36]

Watkins, Maynard and Pangborn brokered culture in the museum world. They brokered the culture or worldview of technologists–machines, inventors, and engineers. In Richard Kurin's view, "culture brokers study, understand, and represent someone's culture (even sometimes their own) to nonspecialized others through various means and media." The concept of brokering "captures the ideas that these representations are to some degree negotiated, dialogical, and driven

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[34]Some recent standard histories of technology that approach technology from cultural and social standpoints include Thomas Hughes, *American Genesis, A Century of Invention and Technological Enthusiasm* (New York, NY: Penguin Books, 1989), Carroll Pursell, *The Machine in America, A Social History of Technology* (Baltimore, MD: Johns Hopkins University Press, 1995), Arnold Pacey, *The Culture of Technology* (Cambridge, MA: MIT Press, 1983, reprint 1994); and Ruth Schwartz Cowan, *A Social History of American Technology* (New York, NY: Oxford University Press, 1997). Other cultural institutions and organizations have begun to be looked at. For example, see works on technologists and religion: Lynn White, *Medieval Religion and Technology* (Berkeley, CA: University of California Press, 1978); Jay Newman, *Religion and Technology: A Study in the Philosophy of Culture* (Westport, CT: Praeger, 1997); and Dora Russell, *The Religion of the Machine Age* (London, UK: Routledge & Kegan Paul, 1983).

[35]Joel J. Orosz, *Curators and Culture*, ix.

[36]The National Museum exercised considerable influence on several historians of technology and on the Society for the History of Technology (SHOT) in its early years in the 1960s. This connection will be discussed more fully in later chapters.

by a variety of interests on behalf of the involved parties."[37] J. Elfreth Watkins, George C. Maynard, and Joseph G. Pangborn brokered the culture of engineering and technology between the world of the technologists, the science-oriented world of museums, and the public audience. They mediated quarrelsome relationships, compromises, and deals among the three groups.

Despite their subordinate place in the institutional hierarchy, Watkins and his supporters outside the museum managed to negotiate a place for enough of a collection that, by the turn of the century, it held a permanent, if subordinate, place at the Smithsonian Institution. Without the work of J. Elfreth Watkins at the end of the nineteenth century and later George C. Maynard, there would have been no foundation upon which to build the National Museum's technological collections in the latter half of the twentieth century. By the turn of the twentieth century, Watkins had brokered technology collections in through the Smithsonian's back door.

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[37]Richard Kurin, *Reflections of a Culture Broker, A View from the Smithsonian* (Washington, DC: Smithsonian Institution Press, 1997), 18.

CHAPTER 1

"From a Single Scientific Truth May Flow a Hundred Inventions"[1]: Smithsonian Increase and Diffusion, and Technology as Knowledge

The United States experienced rapid changes from the Smithsonian Institution's founding in the mid-nineteenth century to the eve of the twentieth century. New groups professionalized and the industrial revolution's impact in America became more pervasive. Technology excited the popular imagination but held little sway in the institutions of science. Forces outside those institutions pushed technology inside. This chapter describes the obstacles to those forces and sets the stage for future negotiations for a place for technological collections. [See Figure 1 for a drawing of the main Smithsonian Building in the nineteenth-century.]

"Knowledge" in the Smithsonian Mission

James Smithson's will, upon which the foundation of the Smithsonian Institution rested, stated: "I bequeath the whole of my property . . . to the United States of America, to found at Washington, under the name of the Smithsonian Institution, an Establishment for the Increase and Diffusion of Knowledge among Men."[2] These few lines started an intense debate over what "increase" meant, what "diffusion" meant, and what constituted "knowledge." Did this "knowledge" include technology? [See Figure 2 for a portrait of James Smithson.]

In 1846, Congress passed a bill chartering the Smithsonian Institution, and its mission became clearer. The establishment would focus on "objects of natural history, including a geological and mineralogical cabinet; also a chemical laboratory, a library, a gallery of art, and the necessary lecture rooms." The staff would collect "all objects of art and of foreign and curious research, and all objects of natural history, plants, and geological and mineralogical specimens,

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[1]Joseph Henry, "Extract from an Address by the Secretary," *Annual Report, Smithsonian Institution, 1853,* 122.

[2]Will of James Smithson, in *Annual Report, Smithsonian Institution, 1853,* 107-108.

belonging, or hereafter to belong, to the United States."[3] The act did not mention technology or the mechanical arts.

Opinion varied regarding Smithson's own view of technology and the "applied" or mechanical arts. According to William Rhees, Chief Clerk of the Smithsonian, Smithson practiced applied as well as pure science in lamp construction and the manufacture of tea and coffee.[4] Even Smithson wrote that "it is to be regretted that those who cultivate science frequently withhold improvements in their apparatus and process, from which they themselves derive advantage, owing to their not deeming them of sufficient magnitude for publication." He argued further that "when the sole view is to further a pursuit of whose importance to mankind a conviction exists, all that can should be imparted, however small may appear the merit which attaches to it."[5] Nonetheless, Smithson acknowledged that "practical questions might be considered of little importance by men of science."

Others saw Smithson's views differently. A secretary of the French Academy, in referring to Smithson's interest in "practical" as well as scientific questions, said that "we ought to be very much obliged to a man such as he is, when he *condescends,* for the public good, to do something which *does not partake of genius.*"[6] In the opinion of Joseph Henry, the Smithsonian's first secretary, "Smithson devoted his life to abstract science and original research, and there cannot be a reasonable doubt that he used the terms 'increase and diffusion of knowledge among men' to imply that the income of his bequest should be devoted to original research in all branches of knowledge susceptible of increase, and the diffusion of the result of this through the press for the benefit of mankind generally."[7]

Smithson's vagueness affected the Smithsonian's mission. In 1862, Henry stated that "the *Museum* of the Institution consists principally of the type specimens of the various collections of

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[3]"An Act to Establish the 'Smithsonian Institution,' for the Increase and Diffusion of knowledge among Men," in Paul H. Oehser, *The Smithsonian,* 2nd ed. (Boulder, CO: Westview Press, 1983), 201, 203, 204.

[4]William J. Rhees, "James Smithson and His Bequest," *Annual Report, Smithsonian Institution, 1879,* 150.

[5]James Smithson, "Some Improvements of Lamps," *Smithsonian Miscellaneous Collections,* No. 327, quoted in *Annual Report, Smithsonian Institution, 1879,* 150.

[6]Rhees, "James Smithson and His Bequest," *Annual Report, Smithsonian Institution, 1879,* 150.

[7]Henry, "Report of the Secretary," *Annual Report, Smithsonian Institution, 1872,* 13.

objects of natural history and ethnology obtained by the different exploring and surveying expeditions sent out by the government of the United States, as well as by various special expeditions instituted at the expense of the Smithsonian fund." Henry consistently wanted to restrict the types of specimens added to the museum collections "to the type specimens collected and described at the expense of the general government, or under the immediate auspices of the Institution."[8] This would not include technology. The Smithsonian personnel would not have added technology to the collections.

Henry himself began a tradition of ambiguity that, while restricting the development of the technological collections, also allowed room for negotiation. Henry's program of organization for the Smithsonian stated that "the will makes no restriction in favor of any particular kind of knowledge; hence all branches are entitled to a share of attention."[9] This ambiguity allowed the addition of technology collections because no clear definition of collections (or "knowledge") existed that said technology did not belong there. Nonetheless, Henry did not want to include technology and popular display. He believed that "the tendency of an institution of this kind, unless guarded against, will be to expend its funds on a heterogeneous collection of objects of mere curiosity; whereas the plan presented in the programme *contemplates complete definite collections arranged for scientific purposes, rather than for popular display.*"[10] The Smithsonian did not guard well enough against this tendency, and technology became a part, albeit a minor one, of those "heterogeneous" collections.

Scientific and Technical Communities in the Nineteenth-Century United States

At the time of the founding of the Smithsonian, a distinction existed between science (discovery for knowledge itself) and technology (applied uses). By the mid-nineteenth century, in historian David Nye's view, the word technology "began to take on the connotation of utilitarianism (as distinct from 'science')." Technology consisted of "machines, patents, and

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[8]Henry, "Report of the Secretary," *Annual Report, Smithsonian Institution, 1862*, 37.

[9]Henry, "Programme of Organization for the Smithsonian Institution," *Annual Report, Smithsonian Institution, 1847*, 4.

[10]Henry, "Museum," *Annual Report, Smithsonian Institution, 1849*, 20-21. Emphasis added.

systems of production," while science "was the province of 'pure' research into fundamentals and did not concern itself with applications."[11] Within the museums, a distinction existed between collections for science and collections for popular consumption (the former being ranked much higher in importance than the latter). Technology collections belonged only with the less important popular ones rather than the important science ones. The influence of world's fairs and some mechanics and engineers, along with George Brown Goode at the USNM, made the Smithsonian gather technology in spite of the fact that it did not, by Henry's definition, belong under increase or diffusion. No clear plans nor any clear institutional support existed for the collection of technology. Pushes, such as enthusiastic collecting for and attendance at the international expositions, came from the outside and aided negotiations for a place dedicated to technological collections.

Henry solicited opinions from contemporary scientific bodies regarding the proposed organization of the Smithsonian Institution. A report by the American Academy of Arts and Sciences (AAAS), dated December 7, 1847, declared that "no particular kind of knowledge is specified by the founder as entitled to preference; all branches are entitled to a share of attention; and the order and degree in which they are cultivated must be decided by a wise regard to means and circumstances."[12] The AAAS report then went on to agree with Henry's proposed "Programme" and quoted from it liberally. Technology did not deserve a share of Smithsonian attention.

James A. Pearce, a US Senator from Maryland and a member of the early Smithsonian Board of Regents, defined technology and arts as applied science. "The most valuable and productive of the arts of life, the most important and wonder-working inventions of modern times, owe their being and value to scientific investigations," he wrote. In Pearce's view, there could not be inventions or inventors without science or scientists because "applications and inventions always result from the discovery of a scientific principle, so that *there are many Fultons for every*

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[11]David Nye, *American Technological Sublime* (Cambridge, MA: MIT Press, 1994), 45-6.

[12]"Report of the Committee of the American Academy of Arts and Sciences, appointed to Consider the Plan Proposed for the Organization the Smithsonian Institution," submitted to the Academy, December 7, 1847, in *Annual Report, Smithsonian Institution, 1853,* 148-49.

Franklin." He maintained that "there is no branch of industrial art which does not owe for the most part its improved processes to such investigations, although the artizans [sic] who employ them are often ignorant of their true source."[13]

Louis Agassiz (1807-1873), a naturalist and zoologist, served as regent at the Smithsonian Institution and leader in the scientific elite of the era. Agassiz dedicated himself to science, not applications. In his opinion regarding the formation of a Museum at the Smithsonian, he suggested collections of living and tertiary shells only. The Smithsonian should not serve as a "general museum" but should limit itself to specimens referred to in papers in the Smithsonian publication *Contributions* and materials upon a few special subjects.[14] Agassiz had a plan for the Smithsonian Institution and its National Museum: separate an exhibition for visitors from a scientific collection for investigators in the museum of comparative zoology. All new museums in the US should be arranged along this line.[15] Upon Agassiz's death in 1873, General James A. Garfield (1831-1881), another Smithsonian regent, Congressman, and later US president, stated that "few lives were ever so sincerely and entirely devoted to the highest and best aims of science." Professor Agassiz had remarked to Garfield that "he had *made it the rule of his life to abandon any intellectual pursuit the moment it became commercially valuable,"* and "he knew that others would utilize what he discovered; that when he brought down the great truths of science to the level of commercial values, a thousand hands would be ready to take them and make them valuable in the markets of the world." Agassiz clearly saw science and application on two different levels. Scientists, moreover, stood above inventors and technologists. Garfield saw Agassiz "as one of that small but elect company of men who dwell on the upper heights, above the plane of commercial values, and who love and seek truth for its own sake."[16]

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[13]"Journal of Proceedings of The Board of Regents of the Smithsonian Institution," *Annual Report, Smithsonian Institution, 1853,* 88. Emphasis added. James A. Pearce (1805-1862) trained in law and served most of his life as a public servant in local Maryland government, state government, and tenures in both the US House of Representatives and the US Senate.

[14]Louis Agassiz, "Communication from Professor Agassiz, Relative to the Formation of a Museum," in *Annual Report, Smithsonian Institution, 1849,* 24-26.

[15]Richard Rathbun, "The United States National Museum: An Account of the Buildings Occupied by the National Collections," *USNM Report, 1903,* 325.

[16]"Journal of Proceedings of the Board of Regents of the Smithsonian Institution," *Annual Report, Smithsonian Institution, 1873,* 150. Emphasis in original.

Alexander Dallas Bache (1806-1867) also held a leading position in the contemporary scientific community. In the words of Joseph Henry, "the early period of his [Bache's] life, including that which preceded his first call to Philadelphia, was almost wholly devoted to the improvement of the mechanical, or the 'doing' faculties of his mind, and but little attention was given to invention, or the exercise of original thought."[17] It remains somewhat unclear whether this reflects more of Bache's views or those of Henry. However, Henry clearly viewed mechanics and discovery differently, and he believed that Bache "progressed" because he went from mechanics and doing to original thought, which had greater overall importance.

Bache's views mattered because he, like Agassiz, wielded influence not only in the outside scientific world but in the administration of the Smithsonian as well. "To say that he [Bache] assisted in shaping the policy of the [Smithsonian] establishment would not be enough," Henry noted, and "it was almost exclusively through his predominating influence that the policy which has given the institution its present celebrity was, after much opposition, finally adopted." Nonetheless, Henry observed that this policy "could only be partially adopted, on account of the restrictions of the enactment of Congress, by which provision was to be made for certain specified objects."[18] Henry's words on this occasion testify to the existence of a political counter force to his plans for the Smithsonian. The influence of Congressional wishes would grow over time, particularly after the 1870s when the USNM began to rely more and more on Congressional appropriations rather than the original Smithson funds.

The views of the outside scientific community also affected Smithsonian development through ethnology and the new discipline of anthropology. From early on, USNM staff focused on ethnology. Indeed, up through at least 1876, the Smithsonian Institution gave special attention

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[17]Joseph Henry, "Eulogy on Prof. Alexander Dallas Bache, Late Superintendent of the United States Coast Survey," *Annual Report, Smithsonian Institution, 1870,* 106. For more information on Bache, see Hugh Richard Slotten, *Patronage, Practice, and the Culture of American Science: Alexander Dallas Bache and the US Coast Survey* (New York, NY: Cambridge University Press, 1994). Interestingly, Alexander Dallas Bache had family and early career links to the world of invention and the mechanic arts. He was the great-grandson of inventor Benjamin Franklin. In addition, he trained as an engineer at the US Military Academy at West Point in the 1820s, and he taught there as Assistant Professor of Engineering from 1825-1826. By 1828, however, he had shifted focus and become Professor of Natural Philosophy and Chemistry at the University of Pennsylvania.

[18]Henry, "Eulogy on Prof. Alexander Dallas Bache," *Annual Report, Smithsonian Institution, 1870,* 102-3.

to ethnology.[19] Even early engineers gave natural history specimens rather than engineering or mechanical specimens. For example, in 1850, two civil engineers donated quartz specimens, and, in the 1870s, engineers donated rock and salt specimens. In 1877, the Smithsonian began a new research section on "anthropology," which quickly became a focus of attention and effort. "Anthropology, or what may be considered natural history of man, is at present the most popular branch of science," Henry reported in 1877. "It absorbs a large share of public attention and many original investigators are assiduously devoted to it. Its object is to reconstruct, as it were, the past history of man, to determine his specific peculiarities and general tendencies."[20]

Interestingly, the focus on anthropology opened up another ambiguous area that would allow room for technological collections. Anthropology included manners and customs, archaeology, ethnology, and languages, but it also included "works of man." In the beginning, man was only primitive man and the "technological" artifacts were only primitive tools. Most Smithsonian staff did not consider antique tools and crafts as technology because they did not come from "civilized" peoples. Examples included arrow-heads, implements, canoes, stone knives, spear-heads, clothing, hatchets, axes, stone pestles, et cetera. By 1871, the reports on antiquities, part of the ethnological section, included information on the "manufacture" of arrow-heads and other primitive items.[21] Technology collections thus started making inroads as part of ethnological collections. As will be seen below, however, the anthropological exhibits also involved the concept of "progress." The "progress" of primitive man led directly to the "rewards" of civilization, namely, technology–another back door opened for negotiation towards technological collections.

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[19]See Henry, "Report of the Secretary," *Annual Report, Smithsonian Institution, 1876,* 32.

[20]Henry, "Report of the Secretary," *Annual Report, Smithsonian Institution, 1877,* 22-24.

[21]For example, see Edward S. Berthoud, "Antiquities on the Cache La Poudre River, Weld County, Colorado Territory," 402-403, W. B. Lyon, "Antiquities in New Mexico," 403-404, and J. Mason Spainhour, "Antiquities in Lenoir County, North Carolina," 404-406, in *Annual Report, Smithsonian Institution, 1871.*

Technology in the Early Smithsonian

The Smithsonian's original plan of organization included some minor references to technology. Henry stated that the plan contemplated "the formation of a museum of physical instruments, which may be used for the experimental illustration and original research, and may serve as models to workmen as well as to illustrate the general progress of inventions in this line."[22] J. R. Priestley, of Northumberland, Pennsylvania, and grandson of the scientist Joseph Priestley, donated possibly the first technological items placed in the Smithsonian: a burning lens and condensing air-pump used by Priestley.[23] The instrument collection, however, eventually focused on the instruments for use rather than as historical or museum artifacts.

In the mid-1850s, public and congressional debate over the plan of the Smithsonian organization continued. The Regents said that they would *"lead, not follow, public opinion."* Their opinion regarding technology and its place in culture and society varied widely from public opinion. They believed that "it is no part of the plan of the Institution to form a museum merely to attract the attention and gratify the curiosity of the casual visitor to the Smithsonian building, but it is the design to form complete collections in certain branches, which may serve to facilitate the study and increase the knowledge of natural history and geology."[24]

In 1855, the official Smithsonian categories for specimens in the collection consisted of Mammals, Birds, Reptiles, Fishes, Invertebrates, and Miscellaneous. The publication categories included clear fields of science and natural history with a few exceptions. In 1867 they included "Chemistry and technology," meaning the chemical arts, ammonia-cobalt bases, and the explosiveness of nitre.[25]

In 1858, the US Patent Office deposited the "government" collections in the Smithsonian Institution. However, the collections from the Patent Office did not consist of technological

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[22]Henry, "Report of the Secretary," *Annual Report, Smithsonian Institution, 1849,* 18.

[23]"Proceedings of the Board of Regents," *Annual Report, Smithsonian Institution, 1859,* 103.

[24]Henry, "Report of the Secretary," *Tenth Annual Report, Smithsonian Institution, 1855,* 13, 31. Emphasis added.

[25]See Baird, "Report of the Assistant Secretary in Charge of the National Museum," *Annual Report, Smithsonian Institution, 1855,* 54, and "List of Publications of the Smithsonian Institution," *Annual Report, Smithsonian Institution, 1867,* 429.

machines or models; rather they included specimens, mainly natural history, collected on various explorations. The Smithsonian had taken the Patent Office's role as curator of the government natural history and ethnology collections.[26] The patent models remained at the Patent Office. After the Patent Office transferred the collections, more than fifty subsequent US Government expeditions added more specimens, particularly in anthropology.[27] Subsequent museum collections came mainly from naval expeditions, United States Geological Surveys, boundary surveys, War and Navy expeditions, and explorations prosecuted by the Institution itself. Ironically, while some of the government expeditions also included railroad survey expeditions, no evidence suggests that they sent important artifacts or samples from their railroad and technological enterprises along with the natural history specimens that they gathered along the railway routes and sent to the Smithsonian.

The earliest Smithsonian publication on a technological subject appeared in 1854. This work proved emblematic of a pattern that would continue at the Smithsonian over the years. Institutional focus would often move toward the interests of the secretary. In this case, the interest was telegraphy and the secretary was Henry, a pioneer in electromagnetism. In the 1854 Annual Report, an article on "The American Fire-Alarm Telegraph," by Dr. W. F. Channing, appeared. Some of the earliest technological collections at the Smithsonian collections encompassed telegraphic and electrical artifacts because they related to physics, an important science, and to Henry's research interests. In 1863, the Smithsonian also published early pieces, mainly science-oriented, on aeronautic voyages and balloon voyages, with topics such as temperature, air flow and meteorology.[28] They included little to nothing on the technology of building balloons and aerial objects.

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[26]Henry, "Report of the Secretary," *Annual Report, Smithsonian Institution, 1858,* 13, 52, 40. With the Patent Office collections came annual Congressional appropriations of $4000.

[27]Henry, "Report of the Secretary," *Annual Report, Smithsonian Institution, 1871,* 40.

[28]See W. F. Channing, "The American Fire-Alarm Telegraph," *Ninth Annual Report, Smithsonian Institution, 1854,* 147-155; Dr. J. Muller, "Report of Recent Progress in Physics–Electricity," in *Annual Report, Smithsonian Institution, 1856,* 357-456; and Francis Arago, "Aeronautic Voyages," 331-348, and James Glaisher, "An Account of Balloon Ascensions," 349-351, in *Annual Report, Smithsonian Institution, 1863.*

The Smithsonian published the first undeniably technological and engineering article in 1860. The annual report included the text of a lecture by Fairman Rogers, Professor of Civil Engineering at the University of Pennsylvania: "On Roads and Bridges." The work included four lectures: an introduction, and construction of roads, bridges and beams.[29] In 1862, the Smithsonian Institution also printed the prize questions of the London Institution of Civil Engineers, which involved clearly technological issues.[30] So technology was not completely absent from the Smithsonian Institution and the USNM. It existed, but subordinate to the primary goals and the important work–science.

The fact that the Smithsonian almost never added items to its collections through direct purchase proved to be a key problem for the development of technology collections at the USNM. Spencer Baird, as Director of the USNM, wrote that "while most large museums, such as the British Museum and those of Paris, Berlin, and Cambridge, Mass., &c., depend principally upon purchases for increasing their collections, the National Museum, without funds at its disposal for such purpose, has not yet felt the need of them." Baird argued that "should Congress at any future time decide to increase the scale of operations so as to enable the establishment to vie with such museums as those of London, Paris, Berlin, Vienna, &c., the framework of the present organization can be readily expanded so as to cover a much wider field." The Smithsonian depended on donations and contributions. The most effective sources proved to be networks of amateur scientists and natural historians, who sent in contributions, and anthropological expeditions, often funded by the Smithsonian from original research funds. Baird observed that "the department of ethnology is one which has received the most varied and extended contributions during the year, due largely to the fact that special effort has been directed by the Smithsonian Institution in the way of circulars to correspondents, and otherwise, to induce the making of such

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[29]Fairman Rogers, "Lectures: On Roads and Bridges," *Annual Report, Smithsonian Institution, 1860,* 123-150.

[30]"Prize Questions of Scientific Societies, London Institution of Civil Engineers, 1863," *Annual Report, Smithsonian Institution, 1862,* 430-33.

collections."[31] Smithsonian officials made no special efforts to attract or gather technological items.

As late as 1880, the Smithsonian advertised its main purpose as the promotion of science, accomplished through "assisting original research, the discovery of new truths, and publish[ing] and distribut[ing] an account of these to the world." The collections comprised "all specimens of natural history, geology, mining, metallurgy, objects of aboriginal workmanship, ancient or modern, etc., belonging to the United States."[32] They included numerous examples that could be considered technology, such as weapons, tools, and implements, but they all related to "primitive" peoples and not "industrialized" societies and, as such, became part of the ethnology collections.

In the view of George C. Maynard (1838-1918), a technology curator around the turn of the twentieth century, "early in the history of the Smithsonian Institution the collection of various specimens for exhibition and study was vigorously prosecuted, but, in this undertaking, the subject of Technology appears to have received no consideration." "The collections made up to about the year 1876 related almost entirely to natural history, geology, zoology and ethnology," he maintained. Maynard understood 1876 as marking a significant shift at the Smithsonian from primitive implements only to mechanical technology. He wrote that "up to the year 1876 the officials of the Smithsonian Institution, and of the National Museum, seem to have received no suggestion that collections designed to show the history of any mechanical art or industry might properly have a place in the exhibits." In Maynard's view, "accessions to the collections prior to this time had included various primitive implements, etc., showing certain stages in the development of arts and handicrafts, but these were all placed in collections relating to archaeology, ethnology, etc."[33] As noted earlier, prior to 1876, the only place for technology in the Smithsonian existed in limited capacity and only within ethnology, anthropology and archaeology.

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[31]Spencer Fullerton Baird, "Condition, Progress, and Operation of the National Museum during the Year 1873," *Annual Report, Smithsonian Institution, 1873*, 37, 45.

[32]William J. Rhees, ed., *Visitors Guide to the Smithsonian Institution and National Museum* (Washington, DC: Judd & Detweiler, Printers & Publishers, 1880), 9, 12.

[33]George C. Maynard, "History of the Division of Technology, September, 1906," Smithsonian Institution Archives (hereafter cited as SIA), Record Unit 297 (hereafter referred to as RU), Box 7, Folder 1.

Joseph Henry and Technology

Joseph Henry became the Smithsonian's first secretary in 1846. His views had a great impact on the shape and purview of the institution for the next thirty years. As noted above, Henry's attitude toward technology and technological collections proved ambiguous. Henry never publicly denigrated technology or invention, but he clearly believed that they differed from science and discovery and he held them in lesser esteem. He also felt that technological collections, even if important, did not belong in the Smithsonian. "The principal object of the organization is the discovery of new truths, rather the application of known principles to useful purposes," he declared in 1851. "Not that the labors of the inventor are undervalued, but because practical knowledge has a marketable value which always insures its cultivation, provided the *higher* philosophical truths on which it is founded are sufficiently developed and made known."[34] [See Figure 3 for a portrait of Joseph Henry.]

As noted above, Henry professed to believe that Smithson's will made no restrictions on the fields of inquiry the Smithsonian supported. But Henry himself, and the Board of Regents, had clear views on what constituted true knowledge versus applications of that knowledge. They used the ambiguity of Smithson's words to exclude areas of invention rather than include them. Henry wrote that "the most prevalent idea, in relation to the will, is that the money was intended exclusively for the diffusion of useful or immediately practical knowledge among the inhabitants of this country, but it [the will] contains nothing from which such an inference can be drawn." Henry argued that "all knowledge is useful," but "from communication of a single scientific truth may flow a hundred inventions, and the *higher* the truth the more important the deductions."[35] Henry also firmly stated that "there can be no reasonable doubt that he [Smithson] intended by the terms 'an establishment for the increase and diffusion of knowledge among men,' an institution to promote the discovery of new truths."[36]

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[34]Henry, "Report of the Secretary," *Annual Report, Smithsonian Institution, 1851*, 10. Emphasis added.

[35]Henry, "Extract from an Address by the Secretary," *Annual Report, Smithsonian Institution, 1853*, 121-22. Emphasis added.

[36]Henry, "Report of the Secretary," *Annual Report, Smithsonian Institution, 1856*, 18.

For Henry, the "discovery of new truths" equated undeniably with science, not technology or invention. In 1857, he wrote:

> My life, as is known to you, has been principally devoted to science, and my investigations in different branches of physics have given me some reputation in the line of original discovery. I have sought, however, no patent for inventions, and solicited no remuneration for my labors, but have freely given their results to the world, expecting only, in return, to enjoy the consciousness of having added, by my investigations, to the sum of human knowledge, and to receive the credit to which they might justly entitle me.[37]

Henry's interest in electricity concerned the "advancement of science," not the "application to the wants of life or useful purposes in the arts." Yet, in 1831, Henry published on the applicability of his electricity research to telegraphs, and he exhibited some applications in 1832. In addition, Henry was a surveyor early in his career and thought seriously about a career as an engineer.[38] Nonetheless, he subsequently made what to him constituted an upward career move, from surveying and engineering to science.

Samuel Morse, the inventor of the telegraph, exemplified the "inventor-citizen" that the United States celebrated in the late nineteenth century, and Henry's view of Morse proves enlightening. He wrote that Morse "had made no discoveries in science," but "he was entitled to the merit of combining and applying the discoveries of others, in the invention of the best practical form of the magnetic telegraph." Henry declared that he was not aware "that Mr. Morse ever made a single original discovery, in electricity, magnetism, or electro-magnetism, applicable to the invention of the telegraph." He considered Morse's merit "to consist in combining and applying the discoveries of others in the invention of a particular instrument and process for telegraphic purposes."[39] In 1857, Henry testified in a patent case involving Morse and a dispute over the rights to the telegraph. Henry, and a special committee of the Smithsonian Board of Regents that

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[37]"Proceedings of the Board of Regents," *Annual Report, Smithsonian Institution, 1857,* 86.

[38]Henry served as engineer in charge of a survey crew on the Great State Road project in New York in 1825. At this early stage of his career, Henry had decided to follow a career in civil engineering. He had become "enamored with the profession of an engineer" [quoted in Moyer, 39]. However, Henry passed on a promising engineering career when he was offered a teaching position at Albany Academy. See Albert E. Moyer, *Joseph Henry, The Rise of an American Scientist* (Washington, DC: Smithsonian Institution Press, 1997), 34-40.

[39]"Report of the Special Committee of the Board of Regents on the Communication of Professor Henry," *Annual Report, Smithsonian Institution, 1857,* 87, 113.

investigated the matter, made a clear distinction between scientific principles and invention/application. In describing Henry's testimony, the special committee stated:

> Professor Henry discovered the law, or 'principle,' as Mr. Morse designates it, which was necessary to make the practical working of the electro-magnetic telegraph at considerable distances possible. . . . Mr. Henry was the discoverer of a principle, Mr. Morse was the inventor of a machine, the object of which was to record characters at a distance, to convey intelligence, in other words, to carry into execution the idea of an electric telegraph.[40]

Henry and the committee also made a distinction between the roles and relative places in society of a scientist and an inventor. The special committee report continued:

> The testimony of Mr. Henry, while supporting the claims of Mr. Morse as the inventor of an admirable invention, denied to him the *additional merit* of being a discoverer of new facts or laws of nature. . . . He [Henry] is a man of science, looking for no other reward than the consciousness of having done something for its promotion, and the reputation which the successful prosecution of scientific investigations and discoveries may justly be expected to give. In his public lectures and published writings he has often pointed out incidentally the possibility of applying the facts and laws of nature discovered by him to practical purposes; he has freely communicated information to those who have sought it from him, among whom has been Mr. Morse himself, as appears by his own acknowledgments. But he has never applied his scientific discoveries to practical ends for his own pecuniary benefit. . . . It was natural, therefore, that he should feel a repugnance to taking any part in the litigation between *vial* inventors, and it was inevitable that, when forced to give his testimony, he [Henry] should distinctly point out what was *so clear* in his own mind and is *so fundamental a fact in the history of human progress, the distinctive functions of the discoverer and inventor who applies discoveries to practical purposes in the business of life.*[41]

Henry himself, in his writings, made a strong distinction between science–the increase of knowledge–and technology–the application of knowledge. In 1859, he wrote that knowledge had "three fundamental distinctions, which must have an important bearing on the future advance of science in this country, namely, the *increase* of knowledge, the *diffusion* of knowledge, and the practical *application* of knowledge to useful purposes in the arts." Henry went on to argue that technological application *required* scientific increase first. "Nearly all the great inventions which distinguish the present century are the results, immediately or remotely, of the application of scientific principles to practical purposes, and in most cases these applications have been suggested

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[40]"Report of the Special Committee of the Board of Regents on the Communication of Professor Henry," 94.

[41]"Report of the Special Committee of the Board of Regents on the Communication of Professor Henry," 95, 97. Emphasis added.

by the student of nature, whose primary object was the discovery of truth," he wrote.[42] Science could continue for its own sake, but there would be no technology without science. "But it is not alone the material advantages which the world enjoys from the study of abstract science on which its claims are founded," he argued, and, "were all further applications of its principles to practical purposes to cease, it would still be entitled to commendation and support on account of its more important effects upon the general mind."[43] In his 1866 report, Henry stated that abstract scientific truths "constitute the most important elements of modern civilization."[44]

Henry did not believe that technology and invention had no importance, only that they had less importance than science and belonged within the purview of other institutions than the Smithsonian. He believed that "the practical application of science to the useful arts has received direct encouragement from the general government by the enactment of patent laws and the establishment of the Patent Office."[45] State legislatures building libraries, schools, academies, and colleges had worked on diffusion. The increase of knowledge had been neglected and thus should be the Smithsonian's primary concern.

Henry made another distinction beyond that of discovery versus application. He also distinguished between collecting specimens to aid original scientific research and collecting specimens for public presentation, education and amusement. Technology had connections with the public and popular, which were not the Smithsonian's main concerns. "The object of the [Smithsonian] collection," Henry emphasized, "is *exclusively the advance of science.*[46] Ironically, because Henry made a distinction between specimen collections for research and those for display, the popular element, and technology with it, could enter the Smithsonian. Henry's distinctions aligned closely with the "increase" and "diffusion" that Smithson mentioned in his will. Although Henry focused on increase, aligning the collection for popular display with diffusion made it a

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[42]Henry, "Report of the Secretary," *Annual Report, Smithsonian Institution, 1859,* 13, 15. Emphasis in original.

[43]Henry, "Report of the Secretary," *Annual Report, Smithsonian Institution, 1859,* 17.

[44]Henry, "Report of the Secretary," *Annual Report, Smithsonian Institution, 1866,* 16.

[45]Henry, "Report of the Secretary," *Annual Report, Smithsonian Institution, 1859,* 14.

[46]Henry, "Report of the Secretary," *Annual Report, Smithsonian Institution, 1870,* 14, 33. Emphasis added.

proper concern for the Institution. In the 1872 Smithsonian Annual Report, Henry quoted from William Swainson, a prominent naturalist of the day: "It is very essential . . . when we speak of the *diffusion* or *extension* of science, that we do not confound these stages of development with *discovery* or *advancement.*"[47] The Smithsonian Institution's focus on original science increased knowledge in several areas of science. A museum for popular education, a clear example of diffusion, should be a distinct establishment. Nonetheless, Henry, in the 1870s, oversaw the birth of the true national museum within the Smithsonian Institution. Congress, after years of debate, finally appropriated a separate amount of $10,000 annually for the National Museum. This appropriation pleased Henry, but he believed that "the public museum should be entirely separated from the Institution."[48] If that had occurred, any semblance of technology would have disappeared from the Institution.

Even in 1876, a momentous year for the National Museum, Henry clearly did not want the Institution to focus on "collecting," but rather on scientific discoveries. "The experience of the last year has strengthened my opinion as to the propriety of a separation of the Institution from the National Museum," he wrote. "The events of this period have proved that the Museum is destined to become an extensive establishment involving a large annual expenditure for its support and a variety of complex operations having no necessary connection with the plan adopted by the Institution for the 'increase and diffusion of knowledge among men'." A museum and a scientific institution had very different functions. For Henry, a museum should focus on "the establishment of a collection of specimens of nature and of art which shall exhibit the natural resources and industry of the country, or present at one view the materials essential to a condition of high civilization which exists in the different States of the American union; to show the various processes of manufacture which have been adopted by us; . . . in short, to form a great educational establishment." A scientific institution "does not offer the results of its operations to the physical eye, but presents them to the mind in the form of new discoveries, derived from new investigations

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[47]Henry, "Report of the Secretary," *Annual Report, Smithsonian Institution, 1872,* 13, footnote. Emphasis in original.

[48]Henry, "Report of the Secretary," *Annual Report, Smithsonian Institution, 1870,* 14, 33.

and an extended exchange of new ideas with all parts of the world."[49] The National Museum had links to popular education, and the Smithsonian, as a scientific institution, should have been above that.

However, Henry's attitude shifted somewhat before his death in 1878. This shift allowed his successor to place more emphasis on the museum. According to museum historian Joel J. Orosz, three events led Henry to give in to the museum idea: the Henry-Jewett feud, the acceptance of the Patent Office collections in 1857, and the Civil War. Joseph Henry and Charles C. Jewett, Assistant Secretary in Charge of the Smithsonian Library, disagreed over the use and disbursement of Smithsonian funds. Jewett felt the split between research and library should be 50-50. Henry disagreed. Spencer Baird, Assistant Secretary in Charge of the Museum, indirectly took Jewett's side by having friends write letters and essays against Joseph Henry. However, in 1854, Henry dismissed Jewett and regained Baird's loyalty. According to Orosz, Henry made a deal with Baird and allowed Baird a free hand to develop a museum. Henry's ideas regarding museums also evolved. Outside pressure pushed Henry as he recognized the public demand for museum education. By the 1870s, Henry was not so anti-museum as in the 1840s and 1850s, but he still worried about the cost of a museum to Smithsonian funds.[50]

On May 13, 1878, Joseph Henry died. According to Spencer Baird, Henry's successor as Smithsonian Secretary, Henry's contribution to the Institution consisted of the following: "The most logical methods of operation and research, the strictest economy of administration, the restriction of the Institution to its legitimate functio· ; in the increase and diffusion of knowledge among men, and the avoidance of all entangling alliances of every kind, signally characterized the administration of affairs by Professor Henry for the long period of nearly one third of a century." Baird expressed his wish that Henry's policy would be permanent.[51]

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[49]Henry, "Report of the Secretary," *Annual Report, Smithsonian Institution, 1876,* 11-12.

[50]See Joel J. Orosz, *Curators and Culture: The Museum Movement in America, 1740-1870* (Tuscaloosa, AL: University of Alabama Press, 1990), 201-206. For a detailed and thorough discussion of the feud, see Joel J. Orosz, "Disloyalty, Dismissal and a Deal: The Development of the National Museum at the Smithsonian Institution, 1846-1855," *Museum Studies Journal* 2 (1986): 22-23.

[51]Spencer Fullerton Baird, "Report of the Secretary," *Annual Report, Smithsonian Institution, 1878,* 7.

In the final analysis, Henry's policy exemplified the way that the Smithsonian administration "developed" the technological collections: without a plan and often against the administration's professed desires. While Henry's stated views appeared to argue against the collection of technological objects, he indirectly originated two key portions of the technological collections at the USNM in the late nineteenth century: physical apparatus and telegraphic apparatus. In 1906, curator George Maynard wrote that Henry "did not favor the establishment by the Smithsonian Institution of anything like a Museum."[52] Research in physical science interested Henry. In pursuit of this research, Henry acquired scientific apparatus for the use of Smithsonian scientists. Henry's own research in electricity and telegraphy led to the collection of some technological apparatus in those fields connected to Henry's investigations. The physical and mechanical apparatuses of other prominent scientists of the era, such as Joseph Priestley, also came to the Smithsonian. Additionally, Henry publicly displayed the apparatus so that, in his own words, "they might serve as models to workmen, as well as to illustrate the general progress of inventions in this line."[53] These apparatuses formed the foundation for larger collections in those fields that became components in the Division of Technology at the turn of the century.

The apparent paradox in Henry's views and actions proved typical of the way in which the technology collections developed in the nineteenth century. A divergence existed between what Smithsonian officials said and what they did. Certain ambiguities in stated views also allowed technology to seep in beyond the strict boundary lines that Smithsonian administrators, such as Henry, tried to establish. These ambiguities allowed negotiation for a place for technology.

Spencer Fullerton Baird and the Technological Collections

After Henry's death, the Smithsonian Board of Regents elected Spencer Fullerton Baird as Secretary. Baird, a natural historian, joined the Smithsonian staff in 1850, and Henry appointed

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[52]George Maynard, Draft Report, SIA, RU 297, Division of Engineering, Box 7, Records, Folder 2, History of Division of Technology, circa 1906.

[53]Henry, quoted in Draft report by George Maynard, SIA, RU 297, Division of Engineering, Box 7, Records, Folder 2, History of Division of Technology, circa 1906. Also see Notes for insert to draft report by George Maynard for additional information on scientific apparatus collection.

him Assistant Secretary. He brought with him a personal collection upon which he based the building of a national museum. Baird directed the National Museum until 1878 and created a model museum for the world-wide museum community, particularly in the area of natural history.[54] Baird's administration aimed at making the collections more accessible, not only to scientists, but also to thc general public. Baird clearly influenced the development of the USNM, but his building of the museum also indirectly affected the development of technological collections. Once the museum had a permanent and secure basis within the Smithsonian, technology collections could more easily find a place. In addition, Baird promoted Smithsonian participation in the 1876 Centennial Exposition in Philadelphia, which had important, if indirect, influences on technology at the Smithsonian.[55] [See Figure 4 for a portrait of Spencer Fullerton Baird.]

In 1872, Henry turned over full administrative responsibility for the USNM to Baird. Baird outwardly supported Henry and his view of the organization of the Smithsonian, but he also had ideas of his own that he built into the museum. Under Baird, the idea of "industry" as part of the proper realm of interest began to seep into the museum. "There can be no question as to the scientific and industrial value of the specimens thus added to the national collections," he insisted, "as they consist, not of the ordinary objects of natural history alone, but of those which show the natural and industrial resources of the country, and constitute, in very great part, that material which to the American manufacturer and producer is of the utmost value as constituting the objects of their study." Baird wanted to bring the importance of technology and the mechanical arts from the world's fairs into the Museum and "render the benefits of the international exhibition permanent to a great degree." He emphasized that "while the lessons of the exhibition are still fresh in mind these objects should be exhibited and attention invited to them."[56]

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[54]For more detailed information on Baird and his research and accomplishments at the Smithsonian, see Paul Oehser, *Sons of Science, The Story of the Smithsonian Institution and Its Leaders* (New York, NY: H. Schuman, 1949); E. F. Ravinius and E. M. Youssef, *Spencer Baird of the Smithsonian* (Washington, DC: Smithsonian Institution Press, 1992); and William Healey Dall, *Spencer Fullerton Baird: A Biography* (Philadelphia, PA: J. B. Lippincott, 1915).

[55]For details regarding the influences of the 1876 Centennial Exposition, see Chapter 2 below.

[56]"Report of Prof. Spencer F. Baird on the Additions, &c., to the Museum in 1876," in *Annual Report, Smithsonian Institution, 1876,* 46.

In 1878, after taking over the secretaryship from Henry, Baird stated that "the relations existing between the Smithsonian Institution and the National Museum have been so frequently referred to by my predecessor that it is only necessary to mention briefly that the Museum constitutes no organic part of the Institution."[57] At the same time, however, that Baird outwardly agreed with Henry's previous plans, he also argued for the importance of new, industrial collections by emphasizing that "these objects [from the 1876 exhibition] are not simply specimens of natural history, possessing an abstract interest to the student, but represent the application of natural objects to the industries, and as such are of great importance." In addition, he wanted to extend the Smithsonian's usefulness beyond the scientific community "to the American manufacturer and designer."[58]

Baird's shift of focus opened the door for the development of technology collections and the negotiation of a place for them. He expanded the defined boundaries of Smithsonian work. Once Baird and others changed the supposedly strict boundaries set up by Henry, room opened up for much more expansion. In addition, Baird's support of Smithsonian participation in the numerous international fairs and expositions in the late nineteenth century allowed ideas of public education, entertainment, and industry to enter the Smithsonian. These concepts all related to popular ideas and beliefs about technology and machines at the time.

In 1878, when the Board of Regents elected Baird Secretary, Baird then made George Brown Goode director of the USNM. Baird also made Goode Curator of the new Department of Arts and Industries in 1884. As will be shown in the next chapter, under Goode the USNM blossomed and technology became a real part of the collections. Even Goode, however, had an ambiguous relationship with technology, both helping and hurting the development of technological collections at the USNM.

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[57]Baird, "Report of the Secretary," *Annual Report, Smithsonian Institution, 1878*, 39.
[58]Baird, "Report of the Secretary," *Annual Report, Smithsonian Institution, 1878*, 41.

FIGURE 1.

Smithsonian Institution Building (the "Castle").
[From *Visitors Guide to the Smithsonian,* 1880.]

FIGURE 2.

James Smithson.
[From *Smithsonian Institution, Annual Report, 1901.*]

FIGURE 3.

Joseph Henry.
[From *Visitors Guide to the Smithsonian Institution,* 1880.]

PROFESSOR JOSEPH HENRY.

FIGURE 4.

Spencer Fullerton Baird.
[From *USNM Bulletin*, No. 20, 1883.]

CHAPTER 2

"What Hath Man Wrought!": The United States National Museum and the 1876 Centennial Exposition in Philadelphia

According to Joseph Henry, "the principal event of the year 1876 connected with the Institution is its display of specimens at the International Exposition in Philadelphia."[1] However, the Exposition primarily affected the anthropology and ethnology sections. It affected technological display at the United States National Museum (USNM) only indirectly. Without pushes from outside the Smithsonian, and eventual brokering between the inside and the outside, there would not have been much technology displayed in the USNM. However, the beginning of the National Museum as a distinct entity within the Smithsonian Institution coupled with the 1876 exposition opened a door for technology collections to enter the Smithsonian.

Birth of the "National" Museum

The first reference to the Smithsonian's museum as a "national" museum appeared as early as 1866 in the "Report of the Secretary" in the Smithsonian *Annual Report.* In the same report, however, Henry wished that the government would soon separate the museum from the Smithsonian as they had the library. "Since Congress has eventually thought proper to assume the care of the library," Henry wrote, "we may cherish the hope that in due time it will also make provision for the separate maintenance of a collection of objects of 'nature and art,' not unworthy of the National Capital."[2] Henry did not oppose a national museum; he merely felt that it did not form a part of the Smithsonian's proper mission.

The mid-1870s saw the true birth of the National Museum. For the first time, in the 1874 Smithsonian *Annual Report,* the listing of officers and assistants included the names of those in charge of divisions of the National Museum. The staff included six "assistants"–a mineralogist, an ornithologist, a zoologist, a taxidermist, a photographer, and a janitor–and six "resident

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[1]Joseph Henry, "Report of the Secretary," *Annual Report, Smithsonian Institution, 1876,* 9.
[2]Henry, "Report of the Secretary," *Annual Report, Smithsonian Institution, 1866,* 16.

collaborators"–in general zoology, invertebrate paleontology, mammalogy and ornithology, malacology, and ethnology.[3] The Smithsonian established the office of curator in 1875. At that time, according to Secretary Henry, the operations of the Smithsonian consisted of two classes: "first, of those relating to the immediate objects of the bequest, viz., the increase and diffusion of knowledge among men, through researches, publications, and exchanges; and, second, those which pertain to the care and management of the Government collections in natural history and ethnology, constituting the *National Museum,* of which the Institution is the custodian."[4] Also in 1875, the museum began to publish the *Bulletin of the National Museum* to illustrate the natural history and ethnology collections in the USNM. The title "National Museum" came into general use with regard to the display of the government collections at the 1876 Centennial Exhibition at Philadelphia. Thus, indirectly, the 1876 exposition proved key in the shift of the collections at the Smithsonian toward a national collection for display rather than just scientific research. By 1883, the name had changed to include "United States."[5]

Congressional recognition and funding played a key role in the establishment of the National Museum as a distinct institution. In the 1876 appropriation bill, the text finally read "appropriation for the National Museum in charge of the Smithsonian Institution."[6] Congress at last recognized the National Museum as a separate establishment within the Smithsonian. A significant increase in Congressional funding for the National Museum also occurred at the end of the 1870s. In 1880, the US Congress increased the appropriations for preservation and installation at the National Museum from $34,500 to $135,000.[7]

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[3]See *Annual Report, Smithsonian Institution, 1874,* 5.

[4]Henry, "Report of the Secretary," *Annual Report, Smithsonian Institution, 1875,* 7-8.

[5]See Richard Rathbun, "Report upon the Condition and Progress of the US National Museum during the year ending June 30, 1900," *USNM Report, 1900,* 4; Baird, "United States National Museum, Report of the Secretary," *Annual Report, Smithsonian Institution, 1883,* 51.

[6]Henry, "Report of the Secretary," *Annual Report, Smithsonian Institution, 1876,* 13.

[7]Baird, "United States National Museum, Report of the Secretary," *Annual Report, Smithsonian Institution, 1884,* 53.

Popular View of Technology and Invention

Several historians have previously argued that popular enthusiasm existed for the mechanical technology and invention of the industrial revolution in the United States in the late nineteenth century.[8] Historians John Kasson and David Nye, in particular, have researched American enthusiasm for technology. For Kasson, nineteenth-century Americans saw in a modern functioning engine a product "capable of eliciting intense aesthetic enjoyment."[9] According to Nye, Americans reverenced technology, and the engineers "imbued technology with moral values."[10] The nineteenth-century *Scientific American* described a locomotive as "a sight both sublime and terrific."[11] Popular books, paintings, stories and other art forms celebrated machines. Americans endowed machines with national identity, and technology dominated American culture as the United States became the world's leading industrial nation. Moreover, steamboats, factories, railroads, and bridges had built that nation. In 1851, Samuel Aiken, an American moralist, declared that "God had sent into the world a legion of strong angels to toil for man in a thousand forms of drudgery and to accomplish for man a thousand achievements which human hands could never accomplish."[12] The enthusiasm for mechanical technology and invention also made nineteenth-century inventors, such as Morse, Bell, Whitney, and Fulton, into mythic American heroes. Americans celebrated inventors who provided an important counterpoint to the long history of artists on which European countries could draw.

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[8]For various discussions of this era of enthusiasm for and celebration of machines and technology as an American symbol, see Thomas P. Hughes, *American Genesis: A Century of Invention and Technological Enthusiasm 1870-1970* (New York, NY: Viking, 1989); Ruth Schwartz Cowan, *A Social History of American Technology* (New York, NY: Oxford University Press, 1997), particularly pages 201-219; Walter Licht, *Industrializing America, The Nineteenth Century* (Baltimore, MD: Johns Hopkins University Press, 1995), particularly pages 46-48; Michael L. Smith, "Recourse of Empire: Landscapes of Progress in Technological America," in *Does Technology Drive History? The Dilemma of Technological Determinism*, ed. M. R. Smith and Leo Marx (Cambridge, MA: MIT Press, 1994), 37-52; Merritt Roe Smith, "Technological Determinism in American Culture," in Smith and Marx, 1-36; and Leo Marx, *The Machine in the Garden, Technology and the Pastoral Ideal in America* (New York, NY: Oxford University Press, 1964).

[9]John Kasson, *Civilizing the Machine: Technology and Republican Values in America, 1776-1900* (New York, NY: Grossman Publishers, 1976), 146.

[10]David E. Nye, *American Technological Sublime* (Cambridge, MA: MIT Press, 1994), xix-xx.

[11]"The American Woodburning Locomotive," *Scientific American*, quoted in Kasson, *Civilizing the Machine*, 172.

[12]Samuel C. Aiken, *Moral View of Railroads, A Discourse, Delivered on Sabbath Morning, Feb. 23, 1851, on the Occasion of the Opening of the Cleveland and Columbus Railroad* (Cleveland, OH: Press of Harris, Fairbanks & Co., 1851), 15.

A key example of the popular enthusiasm for technology was the Brooklyn Bridge, completed in 1883.[13] In a speech made at the bridge's opening, the New York mayor, Abram Hewitt, declared that "when the airy outline of its curves . . . pendent between its massive towers . . . is contrasted with the overreaching vault of heaven above and the ever-moving flood of waters beneath, (which are) the work of omnipotent power, we are irresistibly moved to exclaim: 'What hath man wrought!'"[14] The Brooklyn mayor, Seth Low, stated that "it [the bridge] is a distinctly American triumph. American genius designed it, American skill built it, and American workshops made it."[15]

While Americans felt great enthusiasm for invention and technology, this enthusiasm also contained an element that would not help technology become a permanent part of museum collections. America's technology appeared transient and ever-changing, difficult to preserve. Americans built technology to use and to discard when the next improvement appeared–as it surely would. In addition, popular enthusiasm embraced the monumentality of technological systems such as the railroad system. It aided westward expansion, and, while European railways connected existing population centers, American railways created cities, particularly on the frontiers. Appropriately, the USNM eventually began technology collections in earnest with railroad artifacts. America related to technology as a growing nation using that technology to expand. The sense of growth, expansion, and continual improvement made technology a transitory thing. Museums were not transitory.

The late nineteenth-century international fairs and expositions proved to be key settings showing the enthusiasm for technology and also the transitory nature of technology in America.[16]

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[13]For discussions of the Brooklyn Bridge and its role as an American symbol, see Alan Trachtenberg, *Brooklyn Bridge, Fact and Symbol* (New York, NY: Oxford University Press, 1965), David G. McCullough, *The Great Bridge* (New York, NY: Simon and Schuster, 1972), Margaret Latimer, Brooke Hindle, and Melvin Kranzberg, eds., *Bridge to the Future* (New York, NY: New York Academy of Sciences, 1984), David Nye, *American Technological Sublime,* and Arnold Pacey, *The Maze of Ingenuity, Ideas and Idealism in the Development of Technology,* 2nd. ed. (Cambridge, MA: MIT Press, 1993).

[14]Abram S. Hewitt, May 1883, quoted in Pacey, *The Maze of Ingenuity,* 212.

[15]Quoted in Nye, *American Technological Sublime,* 84.

[16]For discussions of world's fairs and expositions, see Eugene S. Ferguson, "Expositions of Technology, 1851-1900," in *Technology in Western Civilization,* vol. 1, ed. Melvin Kranzberg and Carroll Pursell, Jr., eds. (New York, NY: Oxford University Press, 1967), 706-726; Robert Rydell, *All the World's a Fair: Visions of Empire at American International Expositions, 1876-1916* (Chicago, IL: University of Chicago Press, 1984); John E. Findling, ed., *Historical Dictionary of World's Fairs and Expositions, 1851-1988* (New York, NY: Greenwood

Historian Paul Greenhalgh describes both the technological enthusiasm of the fairs and their transience.

> Imagine an area the size of a small city centre [sic], bristling with dozens of vast buildings set in beautiful gardens; fill the buildings with every conceivable type of commodity and activity known, in the largest possible quantities; surround them with miraculous pieces of engineering technology, with tribes of primitive peoples, reconstructions of ancient and exotic streets, restaurants, theatres [sic], sports stadiums and band-stands . . . After six months, raze this city to the ground and leave nothing behind, save one or two permanent land-marks.[17]

Contemporary writers described the fairs as "devices" at which to bring together "many marvelous mechanical devices." Henry Adams equated fairs and their devotion to technology with religion.[18] William Dean Howells, an observer of the fair, described the attendants and operatives in Machinery Hall at the 1876 Exposition, "at work all day with their life-like machinery, and on every side the thousand creations of American inventive genius were in operation, with an exhilaration and impressiveness in the whole effect which can in no wise be described." In addition, at the fairs, technology–and technological collections–often took on national meaning. "The superior elegance, aptness, and ingenuity of our [American] machinery is observable at a glance," Howells declared, and "in these things of iron and steel the national genius most freely speaks." "We Americans could long ago show machinery whose ingenuity and perfection surpassed anything the insular brain had conceived, and now we show in the utilitarian application of the metals, as in tools, and the like, an easy quality," he continued. "I say nothing of our supremacy in a thousand merely ingenious applications and adaptations: that goes without saying."[19] Throughout the nineteenth century, technology became more closely tied to American nationalism and thus to the National Museum.

Press, 1990); Paul Greenhalgh, *Ephemeral Vistas: A History of the Expositions Universelles, Great Exhibitions and World's Fairs, 1851-1939* (Manchester, UK: Manchester University Press, 1988); E. L. Doctorow, *World's Fair* (New York, NY: Random House, 1985); and Eugene Ferguson, "Technical Museums and International Exhibitions," *Technology and Culture* 6 (1965): 30-46.

[17]Greenhalgh, *Ephemeral Vistas*, 1.

[18]Patrick Geddes, "The Closing Exhibition–Paris 1900," *The Contemporary Review* (November 1900), quoted in Greenhalgh, *Ephemeral Vistas*, 1; Henry Adams, *The Education of Henry Adams* (Boston, MA: Houghton Mifflin Company, 1918), 465.

[19]W. D. Howells, "A Sennight of the Centennial," *Atlantic Monthly* 38 (July 1876): 96, 99, 105.

The giant thirty-nine-feet-high, 680-ton Corliss engine that powered the machines in Machinery Hall symbolized the 1876 Centennial Exhibition in Philadelphia as nothing else did. [See Figure 1 for a depiction of the Corliss engine.] "The majesty of the great Corliss engine, which drives the infinitely varied machinery, remains most distinct," noted William Dean Howells. "The Corliss engine does not lend itself to description; its personal acquaintance must be sought by those who would understand its vast and almost silent grandeur," he continued. "One thinks only of the glorious triumphs of skill and invention."[20] According to historian John Kasson, the Corliss engine had an "overwhelming popularity and acclaim." The engine impressed visitors as "a powerful, indeed monumental, symbol of man's technological triumphs and a titanic form to inspire the romantic imagination."[21] The Smithsonian acquired and displayed a model of this Corliss engine in its Arts and Industries Building, but only in the latter half of the twentieth century. The steam engine took a long trip from the 1876 Philadelphia Exposition to the National Museum.

Even though the enthusiasm for technology proved great in the late-nineteenth century, technology still ranked below science and other elements of elite culture in the views of many. For example, in his opening address for the 1876 Exposition, US President Ulysses Grant described America's accomplishments. Technology–such as ships, roads, canals and machinery–was a necessity. Yet for Grant, technology remained something quite separate from elements of higher civilization–such as law, medicine, theology, science, literature, philosophy and the fine arts.[22]

In the late nineteenth century the draw of technology at the world's fairs began to decline in favor of other forms of mass entertainment: Ferris wheels, exotic dancers, joy-rides, trinket sellers, and more. Exhibitions had become normal events rather than special ones and attendance declined.[23] I believe that this decline may have helped technology to move into the museum setting. Contemporary museum professionals considered the antics and actions of fairs to be

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[20]Howells, "A Sennight of the Centennial," 96.

[21]Kasson, *Civilizing the Machine*, 162.

[22]Quoted in John Maass, *The Glorious Enterprise, The Centennial Exhibition of 1826 and H.J. Schwarzmann, Architect-in-Chief* (Watkins Glen, NY: American Life Foundation, 1973), 43.

[23]For information on the decline of the international exhibitions, see Paul Greenhalgh, *Ephemeral Vistas.*

beneath them. While fair tactics attracted museum professionals because of the potential draw of large audiences, those professionals did not always eagerly imitate the tactics. Once the fairs had shifted emphasis to more exotic and demeaning tactics, such as the events along the midways and pikes, the museums could use technology and enthusiasm to draw popular attention.

Enthusiasm about the changes wrought by the industrial revolution and mechanical technology varied. At the fairs, visitors saw a true image of America as an industrial nation and that status did not please everyone. In particular, many of the cultural elite felt America should look to Europe for aesthetic and cultural values, not to the machines at the fairs.[24] Moreover, the machines and the industrial revolution brought abundance *and* poverty, confidence *and* dismay. Not all American classes benefited from industrial advances. Fair organizers may have even used the fair settings to try to calm some of the fears that came with the rapid industrial change and to equate progress with good for society rather than difficulties for labor. Ironically, the 1877 railroad strike followed the 1876 fair, and the 1894 Pullman strike followed the 1893 fair.[25]

In many cases of protest, however, the machine did not cause the problem in the popular mind. Changes in market activity and the wage labor system caused the problems, and the public did not always associate those with technology.[26] Factories may have caused difficulties in many American workers' lives, but a direct encounter with a rushing locomotive–possibly built in that very factory–could be exciting and awe-inspiring. American machines and engineering structures may have been transitory, but they also often proved large, thrilling, and impossible to ignore.

Leaders of the 1876 Exposition and the Smithsonian at Philadelphia

Robert Rydell and Curtis Hinsley have clearly shown a connection between anthropology in museum settings and anthropology at the world's fairs.[27] In most cases, the people setting up

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[24]See Monte Calvert, "American Technology at World Fairs, 1851-1876" (MA Thesis, University of Delaware, 1962), 189.

[25]See Alan Trachtenberg, *The Incorporation of America, Culture and Society in the Gilded Age* (New York, NY: Hill and Wang, 1982), 38. Also see Robert Rydell, *All the World's a Fair.*

[26]See Licht, *Industrializing America*, 48.

[27]See Robert Rydell, *All the World's a Fair,* and Curtis Hinsley, *Savages and Scientists: The Smithsonian Institution and the Development of American Anthropology, 1846-1910* (Washington, DC: Smithsonian Institution Press, 1981).

the exhibits at the fairs proved to be the very same people who worked for the museums. Such close and direct connections did not exist when it came to the technology exhibits.

From the beginning, Spencer Fullerton Baird, Assistant Secretary of the Smithsonian, became deeply involved with the 1876 Centennial Exposition. In 1873, the US Government appointed him to the Interdepartmental Board that oversaw the government displays. Baird oversaw the preparation and display of exhibits for the Smithsonian, the USNM, and the US Commission of Fish and Fisheries. Moreover, during the exposition, Baird persuaded many exhibitors to donate their exhibits, in part or in whole, to the Smithsonian. This donation would save them the expense of shipping everything back to its origin at the end of the exposition–a great cost for the exhibitors from foreign countries. Baird appointed Thomas Donaldson as agent for the Smithsonian and issued a circular to all Centennial exhibitors introducing Donaldson and his assignment to obtain donations.[28] Secretary Joseph Henry noted that, in 1876, acquisitions from foreign exhibits at the 1876 Exposition proved to be a greater source of increase for the National Museum than the normal sources. Thirty-four of forty foreign countries exhibiting donated some part of their exhibits to the Smithsonian and several States donated their entire exhibits.[29]

Baird and the 1876 Exposition influenced the development of technological collections at the USNM, but only indirectly. Surprisingly, very few of the many carloads of specimens transported back from Philadelphia to Washington included technological relics of the industrial age. They included raw industrial materials and finished industrial products, not the machines that processed the materials into the products, even though those machines appeared prominently in exposition exhibits. The 1876 donations also included a large cache of "technological" items from "primitive" cultures that formed a part of the anthropology and ethnology exhibits. While Baird shifted the Smithsonian's focus from original scientific research to museum collecting, he still did not focus on mechanical technology. In 1879, he wrote "the institution now points with great satisfaction to the progress that has been accomplished in about twenty-two years, at the end of

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[28]For information on Baird's involvement with the 1876 Exposition, see also E. F. Ravinius and E. M. Youssef, *Spencer Baird of the Smithsonian* (Washington, DC: Smithsonian Institution Press, 1992), 122-25.

[29]Henry, "Report of the Secretary," *Annual Report, Smithsonian Institution, 1876,* 38-9.

which time one of the largest and best appointed collections of natural history and ethnology extant has been developed."[30] Baird's work clearly benefited the museum's collections in natural history and ethnology, but not yet in technology.

The central leadership for the 1876 Exposition and the United States Centennial Committee (USCC) included industrialists, politicians, businessmen, and engineers. The president of the exposition was Joseph R. Hawley (1826-1905), an editor and politician from Connecticut. Other businessmen included the Chairman of the Board of Finance, John Welsh (1805-1886), a merchant and philanthropist from Pennsylvania; the head of the USCC Agriculture Department, Burnett Landreth (1842-1928), a farmer and seed merchant from Pennsylvania; the head of the Art Department, John Sartain (1808-1897), an engraver and publisher from Pennsylvania; and the head of Publicity, Charles B. Norton (1825-1891), a publisher and book dealer from New York. Another businessman, Alfred T. Goshorn (1833-1902), served as the exposition's Director-General and used skills that he had developed running Cincinnati's annual industrial fairs from 1869-1872. Military men were also involved, such as the USCC Assistant Secretary, Colonel Myer Asch (1831-1890) from Pennsylvania, and the head of Transportation, Captain Dolphus Torrey (1833-1905)–who had also worked for the Pennsylvania Railroad Company. Henry Pettit (1842-1921) from Pennsylvania and Captain John S. Albert (1835-1880) from New York represented the engineering profession as heads of the Installation and Machinery departments, respectively. A Philadelphia landscaper, Charles H. Miller (1842-1922), led the Horticulture Department, and Boston economist and statistician, Francis A. Walker (1842-1897), controlled the Awards Bureau. Later in life, Walker showed his support for technology and the mechanical arts and won public recognition for technical education as head of the Massachusetts Institute of Technology. John L. Campbell (1850-1904), professor of Physics and Astronomy in Pennsylvania, served as USCC Secretary and has been credited with proposing the original idea for the exposition.[31] None of these men had connections to the Smithsonian or the USNM.

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[30]Baird, "Report of the Secretary," *Annual Report, Smithsonian Institution, 1879,* 66.

[31]For detailed information on the membership and leadership of the United States Centennial Commission for the 1876 Exposition see, "Final Report to the President of the United States, International Exhibition, 1876, United States Centennial Commission," Senate Document 74, 45th Congress, 3rd Session (Washington, DC:

Every US government executive department had a representative for the Exposition.[32] Spencer Fullerton Baird served as the representative from the Smithsonian to the Exposition and took charge of the Smithsonian mineralogical display for the 1876 Exposition. Career military men represented the Navy and War Departments in the form of Admiral Thornton A. Jenkins (1811-1893) and Colonel Stephen C. Lyford (1839-1886), respectively. Colonel Lyford also served as the Chairman of the Board on behalf of the US Executive Departments. The Agriculture Department sent William Saunders (1822-1900), a government horticulturist and landscaper.

In a few rare cases, gentlemen worked for the Exposition as well as the Smithsonian.[33] These persons, however, had nothing to do with technological collections. Thomas Donaldson, a merchant, served on the USCC Board of Finance, as well as a Commissioner from Idaho. He also worked on the Smithsonian mineralogical display for Philadelphia in a volunteer capacity. Professor William P. Blake (1825-1910), a mineralogist and chemist from New York (and later the western territories) also worked on the Smithsonian mineralogy display and the USCC Executive Commission. Neither Blake nor Donaldson, however, headed the mineralogy division at the USNM, which was under the charge of the Museum Assistant F. M. Endlich. John Wanamaker (1838-1922), a merchant from Pennsylvania, served briefly on the USCC Board of Finance in 1873 and 1874. He also served as ex-officio officer of the Smithsonian from 1890-93 while he was Postmaster General of the United States.[34] Wanamaker and Donaldson were also connected with another group that involved many officials from the Exposition–the International Exhibition Company.

After the close of the exhibition in Philadelphia, the International Exhibition Company purchased the main exposition building at Fairmount Park, and many of the exhibits in it, for a

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GPO, 1879). For information on these officers and the bureaus they headed, see also Frank H. Norton, ed., *The Illustrated Historical Register of the United States Centennial Exposition, 1876* (New York, NY: The American News Company, 1877), 87, 109-110, 142, 159-161.

[32]See "Report of the Board on Behalf of United States Executive Departments," House, Misc. Document 20, pt. 1, 47th Congress., 2nd Session (Washington, DC: Government Printing Office, 1884).

[33]There are additional cases of USNM people involved with the 1876 exposition, notably Charles Rau and Otis Mason, along with Spencer Baird. Their only concerns were with the anthropological exhibits and are substantially dealt with in the work of Rydell, *All the World's a Fair*, and Hinsley, *Savages and Scientists*.

[34]All members of the US President's cabinet were ex-officio officers, but they had far less control over the Institution than the Board of Regents.

"continuous international exhibition," to open on May 1, 1877.[35] In the view of the company's officers, "the Centennial Exhibition of 1876 served to bring to the notice of the general public many new and valued products, and to create a demand for many works of industrial and fine art which had not heretofore found a market in this country." They wished to "continue the good effects derived from the Centennial, by affording the unusually favorable facilities to manufacturers and producers to bring their wares to the further notice of the public."[36] The company's exhibits focused on market and manufacturers more than the popular masses.

Several USCC members participated in the new company besides Wanamaker. The company's president, Clement Biddle, served on the USCC Board of Finance. Another member of the Board of Finance, Thomas Cochran, served on the Board of Directors of the new company. Most importantly, the heads of departments in the new company came almost exclusively from among the bureau chiefs of the 1876 Exposition. Henry Pettit headed the Bureau of Management, Dolphus Torrey served as a General Agent, John S. Albert served as a Consulting Engineer for the Machinery Department, and John Sartain led the Fine Arts Department.

Some areas within the company's classification scheme clearly appeared technological. They included sections for

> engineering and architecture, models, plans, &c.; . . . machines, tools and appliances of mining, chemistry and extractive arts, machines for manufacturing vegetable or animal products for food; machines and tools for working metal, wood, and stone; machines and implements used in sewing, spinning, weaving, and felting; washing-machines; machines and apparatus for type-making, printing, lithographing, book and paper making; motors and apparatus for the generation and transmission of power (water, steam, air, gas, electro-magnetic, &c); Railway plant, rolling stock and appurtenances, aerial, pneumatic, and water transportation; . . . agricultural machines, implements, and processes.[37]

Classifications for machines such as those in the company's scheme did not yet exist in the organization of the USNM.

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[35]International Exhibition Company, *Official Bulletin of the International Exhibition, Fairmount Park, Philadelphia, 1877,* (March, 1877, Educational Number, Number 3), Smithsonian Institution Archives (hereafter cited as SIA), RU 70, Exposition Records of the Smithsonian Institution and the United States National Museum, Box 1, Philadelphia, 1876, Folder 2, Circulars.

[36]International Exhibition Company, *Official Bulletin,* 19.

[37]International Exhibition Company, *Official Bulletin,* 20-21.

However, the International Exhibition Company's aims differed from those of the National Museum in collecting. At the Exhibition in Philadelphia, a company bulletin stated that "sales will be permitted in the building under such conditions as will be advantageous for the accomplishment of this object." The Company did try to emphasize education along with the commerce and industry.[38] In the end, however, neither the commerce nor the education efforts proved successful. The International Exhibition Company failed as an enterprise after only a few years. With the company's failure, however, some of its collections went to the Smithsonian in the 1880s.[39]

The Centennial Exposition and the USNM

The main effects of the Centennial Exposition on the USNM included a new building, a shift in focus at the Smithsonian from scientific research to public education, and a spur to the ideas of George Brown Goode, later director of the National Museum, regarding industrial collections. The Exposition had indirect and delayed effects on the technology collections.

The 1876 Philadelphia Exposition brought additional money to the Smithsonian through government funding of exhibits for the exposition. This additional funding had a great impact on the Institution because there had previously been no Congressional appropriations for the purchase of collections. In the words of Goode, "the International Exhibition of 1876 was the beginning of a new period of activity for the National Museum. Before 1876 no money had been expended in the increase of the collections. In 1875, however, Congress voted certain sums, to be expended under the direction of the Smithsonian Institution, for the illustration of the animal and mineral resources of the United States."[40] All told, the government granted $67,000 to the National Museum to prepare a display for the Centennial Exhibition in Philadelphia. The amount for collections totaled only $50,000 since $17,000 went for the erection of a building to house the

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[38]International Exhibition Company, *Official Bulletin*, 19, 7.

[39]Some exhibits also went to the Pennsylvania Museum and School of Industrial Art. See below for further details.

[40]George Brown Goode, "Report of the Assistant Director of the United States National Museum, for the Year 1881," *Annual Report, Smithsonian Institution, 1881*, 87.

Smithsonian display in Philadelphia. The Smithsonian used the rest of the funds to prepare an exhibit of the minerals, animals, fishes and fisheries, and ethnology of the United States.[41] From the very beginning of preparations for the Smithsonian display at Philadelphia, officials planned to use it to expand the Smithsonian collections. Baird wrote in 1875 that "an important consideration in connection with these displays is the fact that their service will not be limited to the period of the Centennial year; but, as the material all belongs to the Government and to the National Museum, it will all be brought back to Washington, where, with proper facilities to be furnished by Congress, it will be displayed to interested visitors."[42] However, the exhibits did not add to the technology collections at USNM. The USNM preparation for the Philadelphia Exposition focused on an exhibition of the natural history and ethnology of the United States.[43] [See Figure 2 for depiction of US Government Building at the Philadelphia Exposition.]

The USNM exhibit at Philadelphia included five sections: the Institution itself and its activities, mineral resources, animal resources, fisheries, and anthropology and archaeology. The anthropology exhibit included an ethnological series described by Henry as objects "to illustrate the domestic life, hunting, fishing, game, warfare, navigation, traveling by land."[44] The items consisted of clothing, ornaments, household utensils, agricultural implements, weapons for war and hunting, and various tools. The archaeology exhibit included ancient implements of stone, metal, and earthenware. These items represented technologies, but the Museum staff of that period did not think of them in that fashion. Technology did not constitute a part of "non-civilized" lives.

The Smithsonian collections increased because the staff, particularly Baird and Goode, specifically requested donations from Philadelphia exhibitors, although not technological donations. A circular written and sent out by Joseph Henry stated that "the Smithsonian Institution desires to secure for the National Museum of the United States under its charge, any specimens of Ethnology, Natural History, Mineralogy, and Geology displayed at the International Exhibition of

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[41]Henry, "Report of the Secretary," *Annual Report, Smithsonian Institution, 1875*, 7-8, 46.
[42]"Detailed Report on Plans by Government Departments Exhibiting at Philadelphia," *Annual Report, Smithsonian Institution, 1875*, 70.
[43]Henry, "Report of the Secretary," *Annual Report, Smithsonian Institution, 1875*, 46.
[44]Henry, "Report of the Secretary," *Annual Report, Smithsonian Institution, 1876*, 33.

1876, that Commissioners and exhibitors are authorized to part with." Articles specifically mentioned in the circular include fisheries' items, ores, minerals, rocks, fossils, mammals and birds, furs, reptiles, fishes, invertebrates, skulls and skeletons, ancient pottery, stone articles, and any objects "illustrating the savage life of recent or present times."[45] Although Baird argued that he wanted to work on the "industrial relation" collections, which "had been entirely neglected previously," the items in the Smithsonian request closely followed the list of already existing departments at the Smithsonian.[46] The USNM sent out circulars only for exhibits of animal resources, ethnology, fisheries, minerals, and shells.[47] Foreign and domestic exhibitors responded generously to the Smithsonian requests for donations. Many key donations came from foreign exhibitors, and these exhibits, according to Baird, often included "the whole or a large part of their animal-, vegetable-, and mineral-, and to a considerable extent their industrial exhibits."[48] Such "industrial" exhibits included raw materials and products, but not industrial machinery or apparatus showing the process by which the raw materials turned into the products.

The items the Smithsonian received included specimens of mining and metallurgy, ores, metals, combustibles, building-stones, earths, clays, tiles, terra-cotta, and pottery, as well as vegetable products, samples of woods, fibers, seeds, medicinal plants, furs, skins, and industrial products such as fabrics and objects in metal, wood, and glass.[49] The donated collections focused on industrial products, not the machinery and technology involved. Some possible technological items included boats, boat fittings, boat models, nets and twine, fishing rods, chisels, bone implements, skinning and tanning implements, knives, tool boxes, oars, gaming implements,

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[45]Circular from Joseph Henry, June 10, 1876, SIA, RU 70, Exposition Records, Box 7, Folder 3, Circulars, 1875-1876.

[46]Henry, "Report of the Secretary," *Annual Report, Smithsonian Institution, 1875,* 46. The catalog departments for accessions as of 1875 were: Mammals, Birds, Reptiles and Amphibians, Fishes, Skeletons and Skulls, Eggs, Crustaceans, Annelids, Mollusks, Radiates, Invertebrate Fossils, Minerals, and Ethnological Specimens. [*Annual Report, Smithsonian Institution, 1875,* 72.]

[47]Various circulars, in SIA, RU 70, Exposition Records of the Smithsonian Institution and the United States National Museum, 1867-1940, Box 1, Folder 2, Laws, 1873-1876.

[48]"Report of Professor Baird on the Centennial Exhibition of 1876," in *Annual Report, Smithsonian Institution, 1876,* 67-68. Also see "Report on the Centennial Exhibition of 1876, January, 1877," in SIA, RU 70, Exposition Records, Box 5, Report on Smithsonian participation in the Centennial Exhibition, 1876-1877, Folder 1.

[49]"Report of Professor Baird on the Centennial Exhibition of 1876," *Annual Report, Smithsonian Institution, 1876,* 77.

harnesses, models of dwellings, arrows, fire apparatus, knives, axes, pottery, miscellaneous tools, lances, war clubs, tomahawks, saddles, saddle-bags, hats, canteens, pitchers, ladles, boots, shoes, moccasins, cradles, baskets, cooking vessels, pestles, mortars, hunting apparatus, a threshing machine, a hydrometer, a cannon ball, a ladder, fire-arms, car wheels, tools, agricultural implements.[50] However, most of these items fell into the Smithsonian classes of anthropology or ethnology.

Since no section in the USNM specifically included technological items, the Smithsonian distributed possible technological accessions to other departments (some not even curatorial). Some of the items of "primitive technology" from the fair eventually ended up in the USNM technological collections, but only after the technology collections had begun with other items. A few of these items were eventually transferred to the Division of Technology long after its establishment in 1885. A technology curator in the twentieth century wrote "a small portion of this material [1876 exposition exhibits] is now in this [technology] Division." However, "the distinction between the number of specimens received by the Museum, which might be classified as technological, and the number of specimens actually in the custody of the Division of Technology must not be overlooked."[51]

The exhibits of other US Government departments included technology. For example, the War Department's exhibit included machinery for the manufacture of cartridges and rifles and telegraphs for the Signal-Service Bureau. The War Department exhibit also included an "Engineer Section" on the history of the Corps of Engineers, accompanied by photographs and drawings of engineering structures (e.g., dams, canals, etc.), astronomical and meteorological instruments, electrical instruments, models of engineering works and appliances, and gun carriages and platforms.[52] The Navy Department displayed naval engines and models of naval vessels. The Department of the Interior included patent models "illustrating the more important stages of

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[50]Exposition Shipping Records, 1876-1877, SIA, RU 70, Exposition Records, Box 6.

[51]George C. Maynard, "History of the Division of Technology," September 1906, SIA, RU 297, Division of Engineering, Box 7, Records, Folder 1, p. 5.

[52]See "Engineer Section War Department Exhibit," "United States Government Participation in the International Exhibition, 1876," House, Misc. Document 20, pt. 1 (Washington, DC: GPO, 1884), 292-345.

development in the industrial and economic arts."[53] However, the technological objects which other government departments displayed did not appear in the accession records of the USNM after the end of the 1876 fair.[54]

From the Smithsonian's founding through at least the 1880s, the collections of the museum portion prove to be difficult to track. With regard to some of the "industrial" items the Smithsonian received from the 1876 exposition, a later technology curator wrote that "an immense quantity of material relating to geology, mineralogy, consisting of ores, crude metals, and a variety of finished products, including miscellaneous tools, etc., were received in the Museum and placed in the charge of the Geology Department." Some of this material may have been transferred later to the Division of Technology, but the curator remained unsure. The museum actually returned many of the tools received from the Centennial Exhibition to their manufacturers. The museum turned other items from the collection, such as nails, tacks, et cetera, over to the Smithsonian carpenter shop, which used them in the Museum work. Several of these items also went to the Smithsonian Property clerk, to be used by the institution when needed. The curator noted that any possible technological items were "dissipated, and the present whereabouts of many of these are unknown; and, that accurate records of these various collections either were never made, or are not now accessible."[55] With regard to objects, the direct connections between the 1876 Exposition and the technology collections at the USNM seemed few.

In the final analysis, the importance of the 1876 Exposition for the technological collections of the USNM came not from donated technological items but from space. The objects led to the erection of an additional museum building for the Smithsonian which allowed space for new sections. The Smithsonian's Arts and Industries Building, completed in 1881, resulted directly from the large number of donations from exhibitors at Philadelphia. Already in 1875, Henry pushed for a new building, based on the anticipated donations. "The number [of Smithsonian

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[53]"United States Government Participation in the International Exhibition, 1876," House, Misc. Document 20, pt. 1 (Washington: GPO, 1884), 4-7.

[54]See SIA, RU 305, Accessions.

[55]SIA, RU 297, Division of Engineering, Box 7, Records, Folder 2, History of Division of Technology, by Maynard (notes), circa 1906.

collections] will be swelled to an extent far beyond the capacity of the present building to contain them," he argued, "and an additional edifice will be required for their accommodation." In 1876, Henry reiterated his request, based on the donations that had started to arrive. "The anticipations expressed . . . in regard to the additions which would be made to the National Museum through the agency of the Centennial Exhibition have been fully realized. . . . To preserve and exhibit this increase . . . an additional building is imperatively demanded."[56]

Over Henry's signature, the National Academy of Sciences (NAS) asked President Grant to recommend that Congress transfer the Government collection at Philadelphia to the Smithsonian. They also asked for continued support of the collection and for a new building. The NAS's push served as the first in a series of outside pushes that aided the development of technological collections at the USNM. Without the new building and more money, there would have been no way to begin collecting and preserving technology. The President bowed to the NAS request. "In view of the urgency of the appeal of the National Academy of Sciences, the President, under date of November 17, 1876, issued an order forbidding the removal of the articles in the Government building until some arrangement could be made in regard to them," noted Assistant Secretary Baird. "The greater part of these articles are now stored in the Government building at Philadelphia, waiting some action on the part of Congress"[57]

In July 1876, Congress granted the Smithsonian the use of the so-called Armory Building on the mall between Sixth and Seventh streets for the storage of the Philadelphia collections. Congress intended the Smithsonian to use the Armory building as a supplement to the main Smithsonian building and to fill it with specimens of ores, metals, marbles, building stones, coals, and objects of natural history received from the Philadelphia exhibits.[58] However, the building proved to be far too small for the proper exhibition of the numerous objects. The Smithsonian used the building exclusively for storage rather than for display.[59] In 1877, the USNM filled the

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[56]Goode, "Report upon the Condition and Progress of the US National Museum during the fiscal year ending June 30, 1886," *USNM Report, 1886*, 4. Henry, "Report of the Secretary," *Annual Report, Smithsonian Institution, 1875*, 8. Henry, "Report of the Secretary," *Annual Report, Smithsonian Institution, 1876*, 11.

[57]Baird, "Report of Professor Baird on the Centennial Exhibition of 1876," 78-79, 80.

[58]Baird, "Report of Professor Baird on the Centennial Exhibition of 1876," 129.

[59]"Journal of the Board of Regents," in *Annual Report, Smithsonian Institution, 1876*, 69.

Armory building "from top to bottom" with Philadelphia donations, as well as other parts of its collections.[60] Baird insisted that "the Centennial collections, being added to the former stock, has precipitated the crisis in this respect and rendered it necessary that some special arrangement be made at an early day for the accommodation of the entire series."[61]

In 1877, the Smithsonian Board of Regents asked Congress to provide funds to erect a building to receive the additional museum collections resulting from donations of exhibits from Philadelphia. The Board presented their request for $250,000 to Congress on February 6, 1877, and again on February 25, 1878.[62] The bill finally passed on March 3, 1879. Baird sounded an important note in his report regarding the new structure. He declared that "the new building will be devoted more particularly to industrial exhibits, intended to show the animal and mineral resources of the United States and their practical applications to the wants or luxuries of man. The department of anthropology will also be largely represented."[63] These "industrial exhibits" remained oriented mainly toward products rather than processes. Nonetheless, they opened a door to the acquisition of machine artifacts used in the industrial process.

The exhibits in the new building continued to focus on ethnology. Baird stated that "the new museum is not intended simply for the exhibition of objects of natural history, the controlling idea being rather that of an ethnological exhibit, especially to include illustrations of the applications of objects belonging to the animal, vegetable, and mineral kingdoms, and the requirements or luxuries of man." A large portion of the new building would hold ethnological collections. However, one-fourth would be assigned to mineral resources, one-fourth to animal industries, and a portion to "other special objects, including the materia medica, foods, paints, and dyes."[64] These areas, although not technological in themselves, formed the nucleus of the Department of Arts and Industries (DAI). The Smithsonian named the building itself the Arts and

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[60]George Brown Goode, *The Smithsonian Institution, 1846-1896: The History of its First Half Century* (Washington, DC: Smithsonian Institution, 1897), 838.

[61]Baird, "Report of Professor Baird on the Centennial Exhibition of 1876," in *Annual Report, Smithsonian Institution, 1876,* 69.

[62]"National Museum Building Commission," *Annual Report, Smithsonian Institution, 1879,* 125. "Report to accompany bill HR2662," House, 45th Congress., 2nd Session (February 25, 1878).

[63]Baird, "Report of the Secretary," *Annual Report, Smithsonian Institution, 1879,* 70, 71.

[64]Baird, "Report of the Secretary," *Annual Report, Smithsonian Institution, 1880,* 45.

Industries Building. DAI would soon become the home of a new department on transportation and engineering. The door opened a little wider for the technological collections. [See Figure 3 for a depiction of the Arts and Industries Building of the Smithsonian Institution.]

Another indirect effect of the 1876 Exposition on technology collections, besides the new building, proved to be a shift in focus at the Smithsonian from original scientific research to public education, which proved more amenable to technological display. George Brown Goode (1851-1896), in the 1881 *Annual Report,* specifically stated that the Exhibition in 1876 had made plain to the people of the United States the educational importance of a great industrial museum. Beginning in 1876, the Smithsonian actively began to gather collections and exhibit them for their educational value. The Smithsonian staff learned this lesson from the Philadelphia Exposition and its great popularity.[65]

As of 1880, no USNM classes specified technological items. The official classifications for specimens in the USNM collections consisted of: skeletons and skulls, mammals, birds, reptiles, fishes, eggs of birds, crustaceans, mollusks, radiates, annelids, fossils, minerals, ethnological specimens (added in 1860), and plants. The 1876 *Annual Report* had mentioned some possible technological items, as distinct from anthropological and ethnological. Remington and Colt guns, some patented items (such as Cruikshank's patent self-acting safety-cleat and rowing-apparatus), and some agricultural implements from Tennessee existed among the accessions for that year.[66] However, these items did not come from the Exposition.

In the 1880s, a delayed effect of the 1876 exhibition on the USNM collections surfaced. Some of the items on display at Philadelphia had gone temporarily to the International Exhibition Company, mentioned earlier. Baird wrote in his annual report that "from among the original exhibits many were either purchased by the company or presented, or deposited by the proprietors." He also noted that "numerous additions were also made, . . . the object being to

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[65]Goode, "Report of the Assistant Director of the United States National Museum, for the Year 1881," *Annual Report, Smithsonian Institution, 1881,* 88.

[66]"Collections," *Annual Report, Smithsonian Institution, 1876,* 106 ff.

have a display of industries, for commercial purposes, and also for the general education and instruction of the community."[67] Some of the items even included the Smithsonian displays.[68]

The benefit to the Smithsonian and the USNM came upon the exhibition company's failure. The organizers of the company, after it did not reach its expected potential, folded the company. Since many of the exhibition items fit within the purview of the USNM, the museum designated an agent to acquire exhibits. Thomas Donaldson negotiated with the exhibition organizers and obtained much of what the USNM wanted through free donations from the company.[69] These contributions became Smithsonian accessions in 1881 and later.

In a later history of the USNM, Frederick True wrote in 1896: "Out of the heterogeneous materials accumulated by the Government, especially as a result of the Centennial Exhibition, Dr. Goode organized, under the approving guidance of Secretary Baird, a public museum of wide scope, attractive, instructive, orderly, and full of the elements of life. He elaborated with the greatest pains a philosophical and comprehensive classification for the collections of the Museum, and planned a complete reorganization of the staff of curators and assistants."[70] In effect, Goode "regenerated" the USNM.

For all the benefits that the Centennial Exhibition provided to the Smithsonian, international expositions in the 1880s began to hurt the Institution. Exposition organizers expected the Smithsonian to present substantial exhibits of their collections and other groups requested loans of

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[67]Baird, "Report of the Secretary," *Annual Report, Smithsonian Institution, 1881,* 35-36. Items on display at the Philadelphia Exposition also ended up at the Pennsylvania Museum and School of Industrial Art. In 1876, the school's Board of Trustees wrote to Baird at the Smithsonian. The museum and school were a fitting memorial of the International Exhibition and would include: ornamental art; "special collections illustrative of industrial process"; "exhibits of raw materials used in the Art Industries"; materials and models of building construction; materials and models of ship building; "Mechanic Arts, comprising models and drawings of machinery, and other collections which may best show the progress of the Arts and Sciences." The Board also addressed a general letter to all exhibitors at Philadelphia, asking for donations of "what articles of your exhibit you would be willing to present to the Museum after the close of the Exhibition." [Board of Trustees, Pennsylvania Museum and School of Industrial Art to Baird, March, 28, 1876, SIA, RU 70, Exposition Records, Box 1, Folder 2.]

[68]The officers of the exhibition company wrote: "I am requested to ask your Institution to leave on exhibition, through next year, the various exhibits that have been given to you, especially by Foreigners, and to supplement it by a representative exhibit of your own. The International Exhibition Co. are prepared to care for them and return them at the end of the time, free of expenses to you." [Clement M. Biddle, International Exhibition Co., to Joseph Henry, November 26, 1876, SIA, RU 70, Exposition Records, Box, Folder 2, Centennial Correspondence, 1875-1877.]

[69]Baird, "Report of the Secretary," *Annual Report, Smithsonian Institution, 1881,* 35-36.

[70]Frederick W. True, "An Account of the United States National Museum," in *USNM Report, 1896,* 305.

items for their own exhibits. In 1888, Samuel Pierpont Langley, then Secretary of the Smithsonian, wrote:

> although sympathizing with the effort to extend the educational work of the Institution and of the National Museum throughout the country, the growing tendency to withdraw for a considerable portion of each year some of the most interesting and valuable parts of the collections, is liable to many objections,--objections which are much stronger now, since the Museum is approaching a final arrangement in classification than some years ago, when the collections were unsettled and unformed. . . . Not only is the work of the entire Museum seriously impaired, but the collections sent out are invariably damaged, some irreparably, some to such a degree that it requires much time and expense to restore them. Furthermore, the standard of local exhibitions is yearly becoming higher, and the local managers are no longer satisfied to accept from us the specimens which, in the judgment of the Museum officials, can be spared, but are disposed to insist upon having the most valuable and costly objects, which if destroyed would be irreplaceable, and if sent at all are especially liable to damage.[71]

Ironically, as Smithsonian officials pushed for fewer connections to international expositions, technological collections began to develop in the USNM.

1881 proved critical for both the USNM and the technological collections. The Smithsonian administration created the Department of Arts and Industries, and the Department eventually became the home of the technological collections. In addition, by 1881, the United States National Museum had become a distinct and permanent institution within the Smithsonian. Baird declared that "the new organization of the National Museum has been successfully established, and it is now in satisfactory working order." And Goode agreed that "the organization of the National Museum may now be regarded as practically completed."[72] The new organization of the museum and the space for the new industrial collections that Goode wanted owed much to the 1876 Exposition. From this point, Goode would become the primary force shaping the USNM until his death in 1896. Under Goode, some outside forces entered the museum to broker a place for technology. In this time, technological collections developed as a permanent part of the National Museum, both because of and in spite of Goode's overarching vision that incorporated technology into anthropology.

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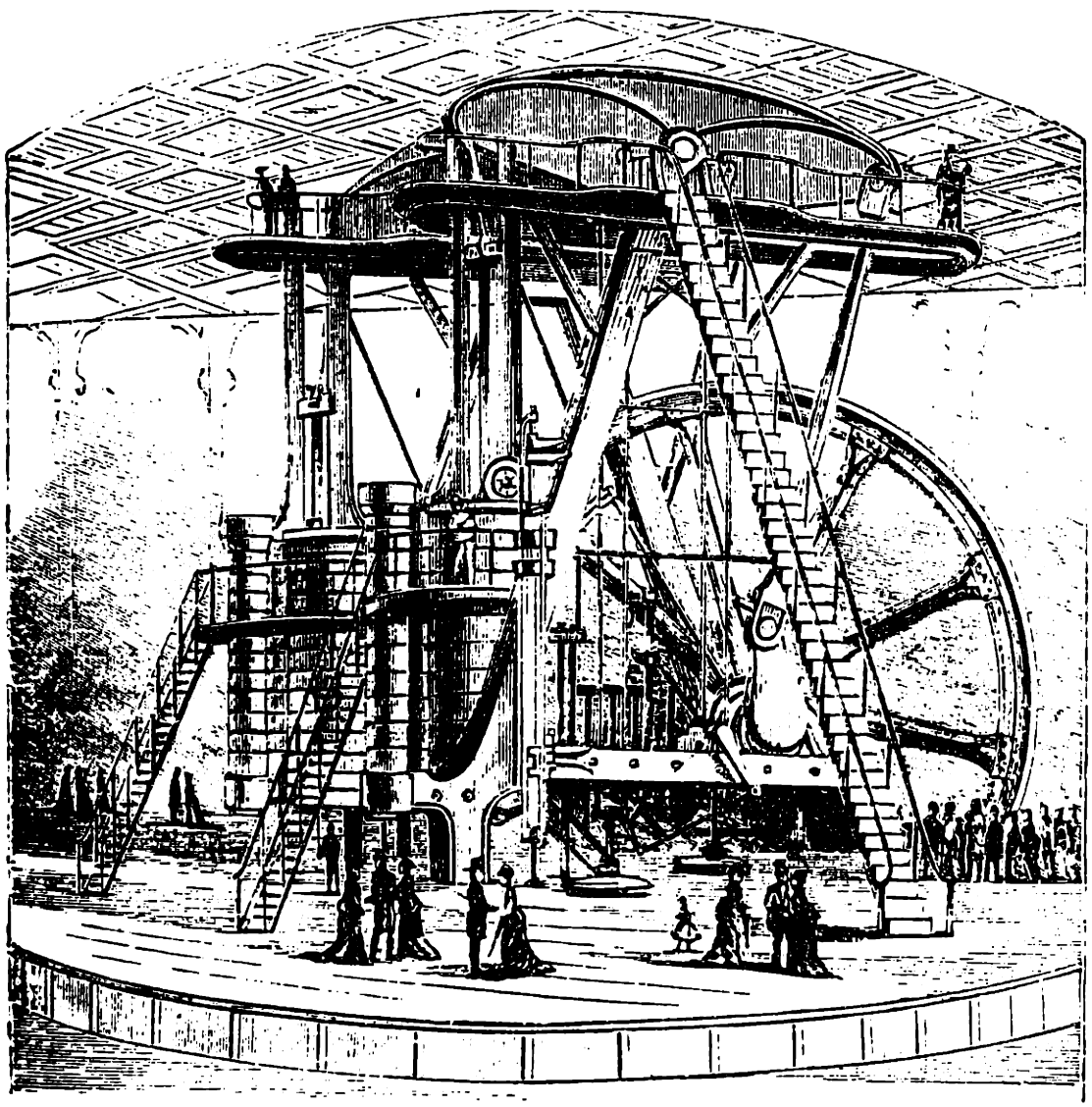
[71]"Report of Samuel P. Langley, Secretary of the Smithsonian Institution, for 1887-'88," *Annual Report, Smithsonian Institution, 1888,* 61.

[72]Baird, "Report of the Secretary," *Annual Report, Smithsonian Institution, 1881,* 1, 35.

FIGURE 1.

Corliss Engine, Machinery Hall, 1876 Centennial Exhibition.
[From *Scientific American*, June 3, 1876.]



THE CORLISS ENGINE IN MACHINERY HALL.

FIGURE 2.

United States Government Building, 1876 Centennial Exhibition.
[From *Scientific American*, May 27, 1876.]

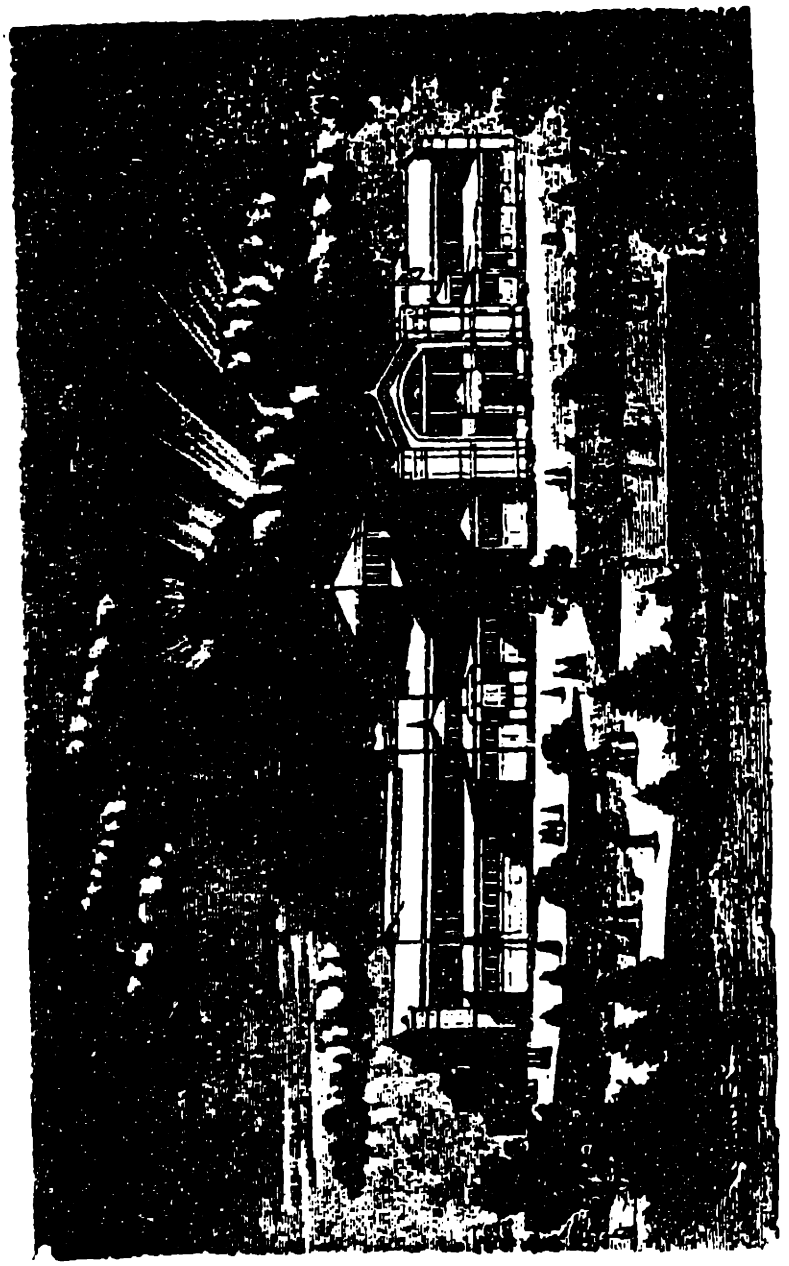
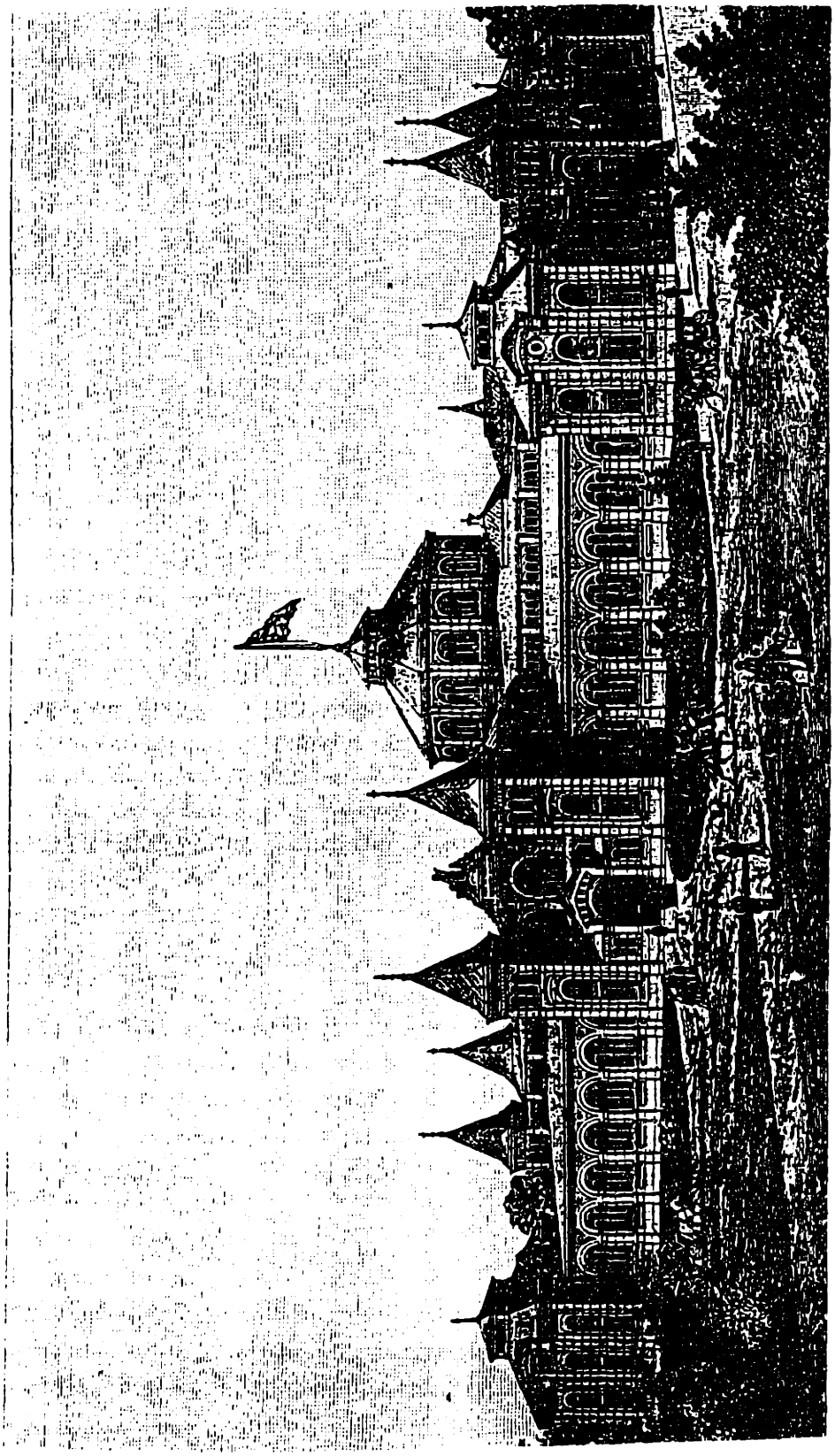


FIGURE 3.

Arts and Industries Building.
[From *Visitors Guide to the Smithsonian Institution*, 1889.]



NATIONAL MUSEUM BUILDING.

CHAPTER 3

A "Guardian Angel" for Arts and Industries: George Brown Goode and New Ideas

George Brown Goode (1851-1896) began his association with the Smithsonian Institution in 1873 as an outside specialist in zoology.[1] By 1875, he became an assistant curator of the National Museum. He became Assistant Director of the National Museum in 1880. Although he did not become Assistant Secretary of the Smithsonian in Charge of the National Museum until 1887, the museum came practically under his control throughout the 1880s.[2] Goode had an overarching vision of the way museums in general, and this museum in particular, should work. [See Figure 1 for portrait of Goode.]

In giving a short outline of USNM history, Goode divided it into three periods: (1) foundation to 1857, in which the museum gathered specimens as materials for research, (2) 1857 to 1876, in which scientific material was deposited and also sometimes exhibited, and (3) 1876 to present [1881], when the Museum performed "active work," gathering educational collections and exhibiting them.[3] For Goode, public education should be the museum's main goal, and his work on the 1876 Philadelphia exposition had revealed this goal clearly. In 1881, he observed that:

> One of the results of the Philadelphia Exhibition of 1876 is that it made plain to the people of the United States the *educational importance of a great industrial museum.* It suggested to the observant the thought that if much that is inspiring and instructive could be imparted by a collection of objects gathered together chiefly with commercial ends in view on the part of the exhibitors, necessarily somewhat unsystematically arranged, and with little effort toward labeling in an instructive manner, an immense field was open for educating the public by gathering together selected series of similar objets, which could be so classified and explained by

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[1]The Smithsonian depended on outside researchers because they did not have the funds for many internal specialists. For specific information on George Brown Goode and his life, see Sally Kohlstedt, ed., *The Origins of Natural Science in America: The Essays of George Brown Goode* (Washington, DC: Smithsonian Institution Press, 1991), and Paul Oehser, "George Brown Goode," chapter in *Sons of Science: The Story of the Smithsonian Institution and Its Leaders* (New York, NY: H. Schuman, 1949).

[2]Spencer Baird received approval to appoint two assistant secretaries. On Jan. 12, 1887, Baird appointed Goode as Assistant Secretary in charge of the National Museum. [Baird, "Report of the Secretary," *Annual Report, Smithsonian Institution, 1887,* 3.]

[3]George Brown Goode, "Report of the Assistant Director of the United States National Museum, for the Year 1881," *Annual Report, Smithsonian Institution, 1881,* 81.

> means of labels and guide-books that they should impart a consistent and systematic idea of the resources of the world and of human achievement.[4]

George Brown Goode contributed classification, labeling, popular display, and public education to museum techniques. George Brown Goode also proved to be a key player in the negotiation for a place for technology collections at the USNM. Through his pushes for and guardianship of a series of museum collections dedicated to the arts and industries, Goode created a place for mediation and compromise between the museum world and the technological community to occur.

Anthropological Classification Scheme for Technological and Industrial Artifacts

Goode developed a new classification scheme for the National Museum. For various reasons, the National Museum never implemented the scheme, but it nonetheless made Goode's ideas and intentions clear. Within his classification system, Goode became the first high museum official to use the term "technology" as a proper field of active operations for the USNM. According to George C. Maynard, a later technology curator, "the first official recommendation of a plan of Museum organization in which technological exhibits are included, found in the printed records, is in the annual report for the year 1881, page 89, in which Dr. G. Brown Goode explains, at great length and in full detail, his ideas on the subject."[5]

Goode's museum and classification system focused on "anthropology," meaning, in his words, "the physical characteristics, the history, the manners, past and present, of all peoples, civilized and savage, and . . . human culture and industry in all their phases; the earth, its physical structure and its products, . . . with special reference to it adaptation for use by man and its resources for his future needs."[6] The classification centered on Goode's idea that "the collections

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[4]Goode, "Report of the Assistant Director of the United States National Museum, for the Year 1881," *Annual Report, Smithsonian Institution, 1881,* 83. Emphasis added.

[5]George C. Maynard, "History of the Division of Technology," SIA, RU 297, Division of Engineering, United States National Museum, 1886-1956, Records, Box 7, Folder 1. Details to which Maynard referred are in the discussion of Goode's classification scheme below.

[6]Goode, "Report of the Assistant Director of the United States National Museum, for the Year 1881," *Annual Report, Smithsonian Institution, 1881,* 89.

should constitute a museum of anthropology, the word 'anthropology' being applied in its most comprehensive sense."[7] Goode's proposed classification was as follows:[8]

Outline of a Scheme of Museum Classification

I. Mankind (anthropology)
II. The Earth as Man's Abode (hexiology)
III. Natural Resources (force and matter)
IV. The Exploitative Industries (exploitative technology): mining, quarrying, lumbering, hunting, fishing, agriculture, horticulture, forestry
V. The Elaborative Industries (elaborative technology): food and perfume preparation, paper manufacture, wood-working, stone-working, metal industries, pottery, glass fabrication, tools/machinery/motors/manufacture and use, construction/architecture/engineering
VI. Ultimate Products and their Utilization (physical condition of man): food, drinks, drugs, dress, furniture, medicine, transportation, recreation, surgery, buildings
VII. Social Relations of Mankind (sociology and its accessories)
VIII. Intellectual Occupations of Mankind (art, science, and philosophy)

Possible expansions of the classification Goode mentioned included culture of animals, transportation, graphic arts, and ceremonies. An expansion into transportation would become a key area for the development of the technological collections at the USNM. Goode urged a transportation division that would show "all that related to modes of movement, roads, tramways, canals, railroads, lines of ocean and river navigation, with the accessories of tunnels, bridges, toll-gates, sign-posts, buoys, light-houses, &c., and vehicles of transportation, from the skate, stilt, snow-shoe, velocipede, and sledge, to the railroad-car, the steamer, and the balloon."[9] This description established the basis for the Section of Transportation which Goode established in the 1880s at the USNM.

The National Museum never fully implemented Goode's classification system. Professionals outside the Museum criticized the classification. Baird, the Director of the Museum, wrote "I read the article criticising [sic] Mr. Goode's plan of the National Museum with much

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[7]Goode, "Department of Arts and Industries," *USNM Report, 1884,* 54.

[8]Goode, "Report of the Assistant Director of the United States National Museum, for the Year 1881," *Annual Report, Smithsonian Institution, 1881,* 89-92. Goode stated that "this classification, while its purpose was to embrace every kind of object which could possibly be exhibited in the Museum, was especially full in those parts which related to the arts and industries, forty-nine out of the sixty-four primary classes relating to this group of museum material." ["Department of Arts and Industries," *Annual Report, Smithsonian Institution, 1882,* 128.]

[9]Goode, "Report of the Assistant Director of the United States National Museum, for the Year 1881," *Annual Report, Smithsonian Institution, 1881,* 93.

entertainment, and it is merely an instance of dogmatism on the part of somebody who probably does not know as much as he thinks he does."[10] Although Baird appeared to support Goode's classification scheme, he never helped Goode implement it. Maynard later observed that "this scheme of Dr. Goode's appears to have been prepared as a philosophical statement for consideration and gradual development, rather than as a practical plan for immediate execution."[11] Goode himself stated later that "it was a purely tentative effort, published for the purpose of inviting criticism." Most of the criticism took aim at Goode's shift away from geographical classification. Goode argued that collections that illustrated the history of human culture needed new systems, such as teleological.[12] Moreover, museums, in various departments, needed to use various classification systems. Goode later wrote about the criticism that "the scientific editors at that time thought it an undesirable innovation to depart from the old plan of a zoological, geological and ethnological museum. I think there has been a decided change in sentiments since then." Although the Smithsonian did not implement Goode's plan, his work nevertheless caused a shift in museum display techniques. His move away from geographical classification also aided the growth of technology collections.

A New Department of Arts and Industries

While the National Museum did not implement many of Goode's ideas, he nonetheless managed to reorganize the museum. In 1880, the Museum appointed an assistant director and designated five assistants as curators. The erection of a new building for the Smithsonian collections aided the reorganization and Goode's plans, particularly since he would devote the new building "more particularly to industrial exhibits." The US Congress made a large appropriation for the building, and, according to Baird, "this required a reorganization of the entire force and a

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[10]Spencer F. Baird to William True, July 25, 1883, SIA, RU 54, Assistant Secretary in charge of the United States National Museum (George Brown Goode), 1877-1896, Records, Box 1, Folder 1.

[11]George C. Maynard, "History of the Division of Technology," SIA, RU 297, Division of Engineering, United States National Museum, 1886-1956, Records, Box 7, Folder 1, p. 8.

[12]Goode, "Report upon the Condition and Progress of the United States National Museum in 1884," *USNM Report, 1884,* 14.

more specific definition of the duties and responsibilities to the Institution."[13] Goode worked particularly on staff and collection problems in the area termed industrial collections. He attempted to gather technological artifacts together and arrange and collect them with a central principle in mind–the "needs of man." He wanted to illustrate "human culture and industry in all its phases."[14] In historian Arthur Molella's view, Goode saw the technological artifacts as "the basis for instructional exhibits on the role of technology in modern society."[15] Goode wanted to develop specific technological departments at the Smithsonian, but he also saw technology as part of society and thus as part of anthropology.

The turning point, as far as the technology collections were concerned, came when the Smithsonian appointed Goode curator of the new Department of Arts and Industries (DAI) in 1881. During that year, Goode also became, in practice, the head of the USNM, writing the complete reports for the museum and reporting directly to Baird, the Smithsonian Secretary. In 1881, Goode, as both head of the USNM and curator of the DAI, had only one assistant. The other curatorial staff covered conchology, ornithology, archaeology, ichthyology, herpetology, invertebrate mammals, mineralogy and chemistry. In 1882, Goode managed to bring in George P. Merrill as assistant for the new section on Building Stones. He also hired A. Howard Clark as an assistant for the DAI. Clark joined curators in the two new sections on naval architecture and textiles.

Baird and Goode established the DAI in 1881 as the first curatorial office to collect objects related to textiles, materia medica, manufacturing and commercial products, historical relics of prominent Americans, scientific instruments, graphic arts, transportation, and coins and medals.[16] The nucleus of the DAI came from exhibits presented to the USNM from foreign representatives at the 1876 Exposition. In practice, the DAI encompassed the objects that fit nowhere else. In

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[13]Baird, "National Museum, Report of the Secretary," *Annual Report, Smithsonian Institution, 1880,* 29, 6, 61.

[14]Goode, "Report of the Assistant Director of the United States National Museum, for the Year 1881," *Annual Report, Smithsonian Institution, 1881,* 89.

[15]Arthur P. Molella, "The Museum That Might Have Been," *Technology and Culture* 32 (1991): 240.

[16]Goode, "Report of the Assistant Director of the United States National Museum, for the Year 1881," *Annual Report, Smithsonian Institution, 1881,* 99-100.

Goode's view, "many of these collections could not properly be incorporated with the material in the custody of any other department in the Museum, and hence arose the necessity for its establishment."[17] He believed that the collections "were neither geological, biological, *nor in the strict sense anthropological.*"[18] Goode formed sub-curatorships within the DAI to handle collections of architecture, musical instruments, modern ceramics, and an unusual collection of historical objects.[19] In general, the DAI became almost a dumping ground for objects that no other USNM department wanted.

The haphazard method of "dumping" artifacts into the DAI did not seem what Goode had planned in his systematic museum organization scheme, noted above. Nonetheless, the haphazardness may have actually opened doors to the creation of new sections. For example, the Smithsonian established a Department of Ethnology in 1884. Surprisingly, this establishment aided technology collections. Ethnology encompassed a group of objects that Goode called "properly technological." Materials, tools, and the products and processes of manufacture appeared prominent in this group.[20] In 1883, Baird described the DAI as including "all ethnological material except that belonging to prehistoric archaeology." According to him, this group encompassed "the arts and industries of civilized as well as of semi-civilized and barbarous races."[21] The inclusion of objects from "civilized" groups brought technology and the mechanical arts into the picture.

Over time, it remained unclear where certain objects belonged, especially "technological" ones. Goode himself wondered whether they should distribute the "technological material" among other departments, as in the early 1880s, or set it aside in a separate exhibit. A lack of appropriate staff, however, made it impractical at first to create a separate department. Goode regretted the lack of a staff "trained to appreciate and to keep abreast of the mechanical and chemical processes of

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[17]Goode, "Review of Work in the Scientific Departments," *USNM Report, 1894*, 73.

[18]Goode, "Review of the Work of the Scientific Departments, including their Participation in the World's Columbian Exposition, Department of Arts and Industries," in *USNM Report, 1893*, 116. Emphasis added.

[19]Goode, "Report of the Assistant Director of the United States National Museum, for the Year 1881," *Annual Report, Smithsonian Institution, 1881*, 99.

[20]Goode, "Review of the Work of the Scientific Departments," in *USNM Report, 1893*, 115.

[21]Baird, "United States National Museum," *Annual Report, Smithsonian Institution, 1883*, 51-2.

modern industrial arts and manufactures, and the arts of design connected with their development." He attempted to attract such a staff in the 1880s and 1890s. The scarcity of a staff, however, did not preclude the growth of the collections. Goode believed that the USNM, by the end of the 1880s, possessed a collection suitable as the foundation for a separate technological museum in Washington, DC. However, Goode proved overly optimistic.[22]

While Goode did not implement the classification scheme described above, the massive amount of new material required some changes in classification. Before the museum moved the collections to the new Arts and Industries Building, Goode had to choose some type of classification that would be practical, particularly for the new items from the Philadelphia Exposition. His decision proved to be important in setting the USNM, and later many American museums, apart from European ones. According to Goode, "after a careful consideration of the methods of the large museums of Europe, the officers of the Museum agreed that *the ordinary classification by races or tribes would in this case be less satisfactory than a classification based upon function.*"[23] This shift to function greatly aided the development of technological collections, primarily in transportation.

The USNM staff began to create "synoptic" series. Goode described these exhibitions of the evolution of a given industry, technology, or class of objects as follows:

> The series should begin with the simplest types and close with the most perfect and elaborate objects of the same class which human effort has produced. In the textile industry, for instance, at one extreme is shown the simple whorl of stone or terra cotta, used by savage or semi-civilized man, together with the archaic representative of the same, surviving among rural members of the most highly civilized races; these being supplemented by the threads and the simple woven fabrics produced by them; on the other hand, the steam spinning apparatus and the power and Jacquard looms.[24]

Goode called the arrangement of DAI "teleological" or "morphological." This arrangement differed greatly from the traditional method of geographical or ethnographical classification (that is, dividing objects according to place or race of origin). Smithsonian Secretary Spencer Baird

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[22]Goode, "Review of the Work of the Scientific Departments," in *USNM Report, 1893,* 116.

[23]Goode, "Department of Arts and Industries," *Annual Report, Smithsonian Institution, 1882,* 128. Emphasis added.

[24]Goode, "Department of Arts and Industries," *Annual Report, Smithsonian Institution, 1882,* 129.

insisted that "in discarding the ethnographic method of arrangement, almost universal among museums, special care has been taken not to sacrifice the possibility of bringing together the objects belonging to any particular locality or race, if this shall at any time be required for purposes of study."[25] By contrast, the arrangement method in the synoptic series allowed objects to reveal "progressive development."[26] Goode's museum method had begun to view objects closer to the way America viewed the history of technology at the time. The development of technology and invention in America would fit well into an arrangement showing progress.

While the number of objects in the DAI grew, the level of organization did not. By 1882, the DAI occupied nearly all of the northern half of the Museum building. [See Figure 2 for Floor Plan of National Museum, circa 1882.] However, the annual reports appeared unclear on how many and which artifacts actually belonged to the department. "It is impossible at present to form any estimate whatever of the extent of the collections in this department," Goode stated. The Ethnology Department accession book recorded over 60,000 entries, some of which Goode believed actually belonged in the DAI. He also believed that some items in the catalogs of the Mineralogy and other departments fit better in the DAI. Moreover, a large quantity of objects remained unentered in the accession records and appeared in no department's catalog.[27]

As the DAI grew, the need for organization grew, but the lack of organization remained. Baird, with Goode's prompting, observed that "the dept. of art and industry must in time necessarily be subdivided into a number of special departments." He noted that there now existed, without plan, "a number of sections in this department, the result of the accumulation of large quantities of material requiring the care of a special officer."[28] The collections that "grew up" without planning included those that would become the transportation section.

The fact that sections grew in a topsy-turvy fashion rather than being planned proved important. The DAI included departments that drifted in to and out of "technological collections,"

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[25]Baird, "United States National Museum," *Annual Report, Smithsonian Institution, 1883,* 51-2.

[26]Goode, "Department of Arts and Industries, Review of the Work of the Scientific Departments," *USNM Report, 1894,* 74. See also, Baird, "United States National Museum," *Annual Report, Smithsonian Institution, 1883,* 51.

[27]Goode, "Department of Arts and Industries," *Annual Report, Smithsonian Institution, 1882,* 129, 130.

[28]Baird, "United States National Museum," *Annual Report, Smithsonian Institution, 1883,* 52.

but mainly drifted in when they had nowhere else to go or no other curator to oversee them. Some of these departments included costumes, textiles, foods, materia medica, graphic arts, and naval architecture. In 1884, materia medica seemed clearly associated with science, not technology. In addition, the Textiles Section included only specimens of raw materials and finished cloth, along with some information regarding textile manufacture and use. Fabrics and materials at different stages of the production process existed but no machines.[29] Eventually, the Textiles Section began to include examples of spinning and weaving devices and to ally with technological sections.[30]

The DAI remained tentative for many years. In 1884, DAI did not have the same footing as other departments in the museum.[31] The DAI's collections included primarily recently acquired objects. In Baird's view, many of those objects would eventually end up assigned to other, more established collections, rather than in the DAI's "general and indefinite" grouping.[32] In fact, after the organization of the Department of Ethnology in 1884, the scope of the DAI shrank and many objects assigned to it moved to Ethnology. Goode, the DAI's main supporter, worried about its continued existence. In 1887, he noted that the department still looked like simply a convenient grouping of items that did not belong in other divisions.[33]

The DAI survived, but it remained a dumping place for objects and clearly secondary to Ethnology. Its curators served in honorary capacities and devoted much of their time to other duties for which they received a salary.[34] But a door had opened for technology collections and a technology section. Curatorial and museum reports clearly labeled some of the "dumped" artifacts as "technological" by the end of the 1880s. These items differed from the ones in other anthropology sections mainly because they came from "civilized" races.[35]

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[29]Romyn Hitchcock, "Report on Section of Textile Industries in the US National Museum, 1884," *USNM Report, 1884,* 77-84.

[30]Baird, "Report of the Secretary," *Annual Report, Smithsonian Institution, 1886,* 33.

[31]Goode, "Department of Arts and Industries," *USNM Report, 1884,* 55.

[32]Baird, "Report of the Secretary," *Annual Report, Smithsonian Institution, 1886,* 28.

[33]Goode, "Report upon the Condition and Progress of the US National Museum during the fiscal year ending June 30, 1887," *USNM Report, 1887,* 9.

[34]Goode, "Review of Work in the Scientific Departments, *USNM Report, 1888,* 28.

[35]Goode, "Report upon the Condition and Progress of the US National Museum during the fiscal year ending June 30, 1887," *USNM Report, 1887,* 9.

The organization of the USNM in 1886 appeared as follows: [36]

Dept. I -- Art and Industry:
- Fisheries and animal products
- Historical relics
- Materia medica
- Naval architecture
- Costumes
- Ceramics (American aboriginal pottery)
- Foods
- Textiles
- Physical Apparatus
- Steam Transportation

Dept. II -- Races of Men (ethnology)
Dept. III -- Antiquities (archaeology)
Dept. IV -- Mammals
Dept. V, A. -- Birds
Dept. V, B. -- Birds' Eggs
Dept. VI. -- Reptiles and Batrachians
Dept. VII. -- Fishes
Dept. VIII. -- Comparative Anatomy
Dept. IX. -- Mollusks, including Cenozoic fossils
Dept. X. -- Insects
Dept. XI. -- Marine Invertebrates
Dept. XII, A. -- Invertebrate fossils (Paleozoic)
Dept. XII, B. -- Invertebrate fossils (Mesozoic)
Dept. XIII. -- Plants
Dept. XIV. -- Minerals
Dept. XV. -- Lithology and physical geology
Dept. XVI. -- Metallurgy and economic geology

A New Museology

In the long run, Goode's ideas and concepts regarding museum practice affected not only the Smithsonian Institution but also museum practice in general. Indeed, he developed a new museology. In 1880, he visited all the principal museums in Germany, Italy, and Great Britain. He based many ideas for the plan of the National Museum on observations from this trip.[37] In turn, museums across America and around the world looked to Goode's practices as the standard to follow.

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[36]"Organization of Departments," *Annual Report, Smithsonian Institution, 1885,* 29

[37]See Baird, "National Museum," *Annual Report, Smithsonian Institution, 1879,* 69-71, Baird, "National Museum," *Annual Report, Smithsonian Institution, 1880,* 45-46, and Goode, "Report of the Assistant Director of the United States National Museum, for the Year 1881," *Annual Report, Smithsonian Institution, 1881,* 81-88.

Goode, as curator and assistant director of the USNM, planned the exhibitions for the new Arts and Industries Building under Secretary Baird's direction. Goode's guiding philosophy was that the museum should be a museum of record to preserve the material foundation of scientific knowledge, a museum of research to be a resource for scientific investigators, and an educational museum utilizing its specimens to illustrate every kind of natural object and every manifestation of human thought and activity. Goode wanted "an exhibition of ideas rather than of objects" in which "nothing will be deemed worthy of admission to its halls which has not some living, inspiring thought behind it, and which is not capable of teaching some valuable lesson."[38] "A finished museum is a dead museum, and a dead museum is a useless museum," he declared, and "many so-called 'museums' are little more than storehouses filled with the materials of which museums are made."[39]

Goode's thinking accordingly shifted the museum's emphasis from collections for study to collections for popular display and education. As noted above, his museology divided museums into three types: museums for record, for research, and for education. He wrote that "the contents of the museum of research and the museum of record, if no other objects are sought, might without impropriety be stored away in vaults and cabinets, inaccessible to any except the specialist." Goode proved to be instrumental in a shift away from museums for specialists and toward museums for the public. He argued that museums of record and research "should be arranged in such a manner that hundreds of thousands of people should profit by their examination instead of a very limited number," and they "should afford a means of culture and instruction to every person, young or old, who may have opportunity to visit the place in which they are preserved."[40]

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[38]Goode, "First Draft of a System of Classification for the World's Columbian Exposition," in *USNM Report, 1891*, 656.

[39]Goode, "The Principles of Museum Administration," Annual Report of the Museums Association, 1895. Reprinted in *A Memorial of George Brown Goode, together with a Selection of his Papers on Museums and on the History of Science in America, Part II, Report of the U. S. National Museum, Annual Report of the Board of Regents of the Smithsonian Institution, showing the Operations, Expenditures, and Condition of the Institution for the Year Ending June 30, 1897* (Washington, DC: Government Printing Office, 1901), 201.

[40]Goode, "Report of the Assistant Director of the United States National Museum, for the Year 1881," *Annual Report, Smithsonian Institution, 1881*, 82. See also Goode, "Report upon the Condition and Progress of the United States National Museum in 1884", *USNM Report, 1884*, 7-8.

Goode's experience with international expositions revealed to him the possibilities of museums as places for popular education. "The Educational Museum . . . may be considered as one of the outgrowths of the modern industrial exhibition," he wrote. "The World's Fair of London in 1851 . . .was utilized by the Government of Great Britain as a starting-point for a number of national and educational museums . . . and the subsequent World's Fairs have been utilized in a similar manner, so that nearly every civilized country now has museums of this description."[41] For Goode, the National Museum should serve as "a permanent exposition of science and industry."[42]

Museums, however, could outdo the commercial world and the aims of the fairs rather than just imitate them. Goode clearly distinguished museums from expositions. "In referring to the industries of America it *is not intended to recommend that anything similar to what is generally understood as an 'industrial exhibition' should be attempted,*" he argued. "The element of competitive display should not be admitted, and not two objects of *precisely* similar import should ever be placed side by side, least of all, if of modern manufacture."[43] In 1895, Goode described "the relation of the museum to the exposition" as follows: 1) they differ in both aims and in method; 2) expositions promote industry and commerce and museums advance learning; 3) an exposition exhibit's aim is financial advantage to the exhibitor, while a museum exhibit's aim should be a lesson; 4) expositions include competition for awards and potential customers, while museums have no competition among exhibits; and 5) the educational results of expositions, though important, are primarily incidental, while museums plan for educational exhibits.[44] Although museums and expositions differed, Goode believed that museums should be able to build on the good and educational aspects of the fairs. Museum methods could improve upon exposition displays. Goode insisted that "exhibitions have for their primary object the stimulation of commerce and manufactures–popular education is incidental." "Museums are <u>first of all</u>

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[41]Goode, "Report of the Assistant Director of the United States National Museum, for the Year 1881," *Annual Report, Smithsonian Institution, 1881,* 83.
[42]Goode, "First Draft of a System of Classification for the World's Columbian Exposition," 655.
[43]Baird, "Report of the Secretary," *Annual Report, Smithsonian Institution, 1886,* 28. Emphasis added.
[44]Goode, "The Principles of Museum Administration," 197.

educational," he contrasted. "In a given limited amount of space, museum methods are a hundred-fold more effective than exhibition methods."[45]

Goode urged museums to fill the "chasm" between industrial museums displaying high art design--such as royal armor and palace furniture--and ethnology museums showing savage implements and costumes. "A museum which attempts to show the evolution of civilization," he maintained, "should preserve the simplest products, the every-day costumes, together with the tools and appliances which have been in common use by civilized man in the present and past centuries."[46]

Goode focused on public education and attendance, but his view was not naive. "The majority of visitors to any museum go thither in search of amusement, or from a mere idle curiosity," he observed. "Many have no desire to gain instruction, and most of those, if actuated by such a desire, fail to accomplish their object by a visit to the ordinary museum."[47] In his view, "museums needed to take three groups into consideration: independent researchers, students, and casual visitors." "The casual visitors, who in point of numbers exceed the other classes, make quite different demands," Goode pointed out. "They do not come to a museum to study in detail any single group of objects, but from intelligent curiosity to see the wonders of nature, the masterpieces of art, and those things which illustrate in the most striking manner the history and progress of civilization."[48] The public subsequently played an important role in the fight over museum mission and in the negotiations for certain popular areas of collection.

His emphasis on education and the public led Goode to emphasize labeling in museums. In 1884, he wrote that "an efficient educational museum, from one point of view, may be described as a collection of instructive labels, each illustrated by a well-selected specimen." For Goode, the

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[45]Goode to Senator Hawley, August 8, 1889, SIA, RU 54, Assistant Secretary in charge of the United States National Museum (George Brown Goode), 1877-1896, Records, Box 3, Volume 2, 112-128. Emphasis in original.

[46]Goode, "Report of the Assistant Director of the United States National Museum, for the Year 1881," *Annual Report, Smithsonian Institution, 1881*, 86.

[47]Goode, "Report of the Assistant Director of the United States National Museum, for the Year 1881," 84-5.

[48]Goode, "Report upon the Condition and Progress of the US National Museum during the year ending June 30, 1891," *USNM Report, 1891*, 5-6.

labels had almost more importance than the artifacts. He compared the artifacts to "piles of brick, stone, lumber, and architectural ornaments, which by themselves possess little apparent interest, but which may by thought and labor be combined into an imposing and useful edifice."[49] Specimen labels mortared the artifacts together in a meaningful way to create a true educational museum.

The importance of Goode's views on the new museology lay in the fact that other museum professionals listened to and followed him. "Goode's contributions to museum administration and the history of museums were not confined to his own work," noted Samuel Langley, a Smithsonian Secretary. "From all parts of America and even as far distant as Australia his opinion was sought with regard to the plans for museum buildings as well as on minor matters of installation."[50] Upon Goode's death, not only American museologists eulogized Goode, but museologists world-wide as well. A tribute from the Field Columbian Museum in Chicago stated that "Doctor Goode . . . did more than any other person in America to engraft upon them [exhibitions] Museum ideas and alter their scope from the mainly commercial and industrial to the educational and scientific."[51] In Great Britain, the *Manchester Guardian* wrote that Goode "was a recognized authority on all matters affecting museum administration. . . . and he not only achieved much in his own country, but was also ever ready to cordially co-operate with foreign kindred institutions, especially those in England, for the advancement of museum work as a means of education."[52]

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[49]Goode, "Report upon the Condition and Progress of the United States National Museum in 1884," *USNM Report, 1884,* 11.

[50]"Memoir of George Brown Goode, 1851-1896," by S. P. Langley, read before the National Academy, April 21, 1897, SIA, RU 7050, George Brown Goode Collection, Box 26, "Biographical Sketches of G. Brown Goode" Folder.

[51]"Tribute from the Field Columbian Museum," SIA, RU 7050, George Brown Goode Collection, Box 26, "Biographical Sketches of G. Brown Goode" Folder.

[52]*Manchester Guardian,* October 25, 1896, SIA, RU 7050, George Brown Goode Collection, Box 26, "Biographical Sketches of G. Brown Goode" Folder.

Goode's Views on Technology

Goode's views and the museology he developed, unlike those of earlier museum professionals, included technology. They also included the developers, practitioners, and users of technology. In 1888, Goode observed that "the museum of the future in this democratic land should be adapted to the needs of the mechanic, the factory operator, the day laborer, the salesman, and the clerk, as much as to those of the professional man and the man of leisure." Nonetheless, Goode, like scientists before him, continued to divide knowledge into two areas. "All intellectual work may be divided into two classes," he wrote, "the one tending toward the increase of knowledge, the other toward its diffusion; the one toward investigation and discovery, the other toward the education of the people and the application of known facts to promoting their material welfare."[53] Goode differed in the fact that he strongly believed that the museum should do both; both mattered.

Goode believed that technology deserved the same attention as science and art. "As a matter of convenience, museums are commonly classed in two groups--those of science and those of art," he wrote. "This classification [science and art] is not entirely satisfactory," he maintained, "since it is based upon methods of arrangement rather than upon the nature of the objects to be arranged, and since it leaves in a middle territory (only partially occupied by the English museum men of either department) a great mass of museum material, of the greatest moment, both in regard to its interest and its adaptability for purposes of public instruction." Goode placed technology in that middle territory, although he did not yet know what to call it. Between natural history and fine art existed "a territory which no English word can adequately describe--the natural history of civilization, of man and his ideas and achievements."[54] This territory did not strictly equate with technology, but it did finally allow a place in the museum into which technology would naturally fit.

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[53]Goode, "Museum-History and Museums of History," presented at American Historical Association meetings, Washington City, December 26-28, 1888, Reprinted in *USNM Report, 1897*, 73.

[54]Goode, "Museum-History and Museums of History," 75-76

Goode urged specialization rather than generalization for museums. His overall classification of museums included (a) art museums; (b) historical museums; (c) anthropological museums; (d) natural history museums; (e) technological or industrial museums; and (f) commercial museums. As late as 1895, he observed that no institutions of the type "technological or industrial" existed. "The possibility of establishing such a museum remains to be demonstrated," he noted. "Attempts have been made at the close of various international expositions, but without success."[55] However, even Goode hesitated about whether such museums could actually work. He, like others, equated technology with something fluid and changing, which made it a difficult subject for a permanent institution such as a museum. "It is possible that experience may show that museum work in this field can best be done in connection with museums of natural history and anthropology," he wrote in 1895. "After all, *a factory in actual operation is the best place to study most modern industries.* The constantly changing interest of commerce . . . might safely be left to the exposition and fair, or, if need be, cared for by commercial organizations." Goode noted that Philadelphia had a "permanent exhibition of objects and materials used in the construction and ornamentation of houses, kept by the Building Trades' Association."[56]

Goode wrote a manuscript on the history of American science, which also included his views on technology. He wrote:

> In discussing the growth and influence of science it seems legitimate to consider all that has grown directly out of the work of our scientific men and institutions. The distinction between pure and applied science cannot be sharply drawn, and, indeed, ought not to be. An individual who uses the treasures of scientific fact, and an acquaintance with scientific laws to utilize the forces of nature in the interest of civilization is no less a man of science than he who applies himself to some refinement of method or theory in pure science. It is not just to characterize him simply as an inventor. The application of her discoveries for the welfare of mankind is one of the glories of Science, one of the ultimate tests of the validity of her work, and the chief argument for the endowment and support of those who labor in her name.[57]

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[55]Goode, "The Principles of Museum Administration," Reprinted from the Annual Report of the Museums Association, 1895, in *USNM Report, 1897*, 202, 213-4.

[56]Goode, "The Principles of Museum Administration," 214. Emphasis in original.

[57]Goode, "History of American Science," unpublished manuscript, SIA, RU 7050, George Brown Goode Collection, Box 24, Folder 4, 7-8.

Goode clearly saw technology as important. He also believed that the inventor or "technologist" should be celebrated next to the scientist.

While Goode viewed technology as part of science (specifically as applied science), he also made a distinction between discovery–equated with science–and invention–equated with technology. He tried to cover both in his manuscript, "History of American Science," and in his National Museum work.[58] For example, in his section on electricity in the manuscript, Goode described Joseph Henry's research as discovery. Goode then proceeded to discuss inventions and applications using Henry's research: the telegraph, rotary engines, electric railroads and the telephone.[59] He also urged more emphasis on other areas in the Smithsonian publications. An annual feature in the Smithsonian reports regarding "Recent Scientific Progress" discussed astronomy, geology, physics, chemistry, mineralogy, botany, zoology, and anthropology. Goode regretted that the Smithsonian secretaries, in acquiring collaborators for this feature had ignored areas such as "terrestrial physics and meteorology, geography and hydrography, microscopy, &c., as well as the more practical topics of agricultural and horticultural economy, *engineering, technology,* and industrial statistics."[60]

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[58]The subjects that Goode specifically treated in his manuscript included mathematics, astronomy, geodesy, meteorology, geology, physics (including work on electricity and telegraphy, and electro-magnetism as a motive power), chemistry and mineralogy, mechanical science & engineering, zoology, anatomy and physiology, botany, geography and exploration, anthropology, scientific bibliography, and applied science.

[59]Goode wrote: "Another application of electricity, equal perhaps in importance to the telegraph, was first worked out through American ingenuity, when in 1829, Joseph Henry conceived the idea of electro-magnetism as a motive power and constructed an electromagnetic machine with automatic pole changes–to illustrate the manner in which this force might be applied. Henry's oscillatory machine was the forerunner of all our modern dynamos, and the rotary motor is a direct outgrowth of Henry's improvements in magnets. . . . Thomas Davenport, a blacksmith from Brandon, Vermont, visited those iron works and saw Henry's invention at work. He bought one of the magnets, and taking it home with him, used it in the experiments which led to the construction of his live motor. By 1834, Davenport had worked out a rotary engine, which he patented and publicly exhibited in the following year." A second machine built by Davenport "resembled a little steam engine, the repeated removal of the magnetic poles producing, instead of a rotary motion as heretofore, a movement like a piston rod. . . . Another and more important outgrowth of the application of Henry's method by Davenport was the beginning of the electric railroad. . . . The electric railway in all its essential features may, without hesitation, be classed as one of America's contributions to the forces of civilization. . . . The telephone, whose economic importance (like that of the telegraph) has thrown its scientific interest somewhat into obscurity, was, in its first stages at least, a discovery rather than an invention." Goode was making a distinction between discovery and invention, but both were important to Goode. "The work of Americans in economic science, statistics, sociology, mechanical science and engineering, and in other departments of applied science, including medicine, surgery, hygiene, agriculture in all its branches, fish-culture, mining and metallurgy, the various departments of applied chemistry and physics, can barely be touched upon if mentioned at all, but in all these departments advances have been made, and the improvements which have begun in other parts of the world have been eagerly received and put into effect by our countrymen." [Goode, "History of American Science," 170, 172, 175, 275.]

[60]Goode, "Record of Scientific Progress," *Annual Report, Smithsonian Institution, 1880,* 181. Emphasis

One view of Goode's seemed to run counter to public imagination at the time. He appeared to claim that the United States did NOT lead the way in applied science and invention. "Although it is the general belief among Americans that our country leads the world in applied science and invention, it is not so," he argued. "Notwithstanding the vast material interests in this country, which depend upon the application of mechanical science, it may be said without fear of contradiction that *the outcome in the way of new and epoch making discoveries has been less than might properly be expected."* In his view, Americans had primarily made advances "by adoption, adaptation, and improvement of European ideas, and in the organizing of great commercial enterprises requiring large capital and vast expenditures of energy."[61] However, Goode actually claimed that Americans had failed in the field of discovery–that is, science–not invention. "We have by the thousand skillful engineers, –mechanical, civil, electrical–men full of energy, courage, and ingenuity," he declared, "but after all, with, of course, a goodly number of exceptions, these men have done *comparatively little that was original."* "It is in the line of mechanical inventions, involving knowledge of ingenious labor-saving devices, improvements of machinery and the like, that the Yankee has done the most," he argued. Nonetheless, Goode still placed discovery *above* application. "In the *higher* fields, where a knowledge of mathematics, physics, and chemistry is required, and in which inventions *rise* to the same plane of dignity as scientific discovery, the showing is not so good."[62]

Goode blamed the failure of American inventiveness to rise to the level of science on a "lack of adequate provisions for technical instruction" and a "negative attitude of our colleges, universities, and learned bodies toward applied science." For example, the National Academy of Sciences did not contain a member to represent applied science. "A section of Mechanical Science and Engineering was founded in the American Association about ten years ago, but it has never been well sustained," Goode argued, "notwithstanding the various memberships in the several

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added.

[61]Goode, "History of American Science," 212. Emphasis added.
[62]Goode, "History of American Science," 212. Emphasis added.

National Technical Associations from which its membership, one would suppose, might have been recruited."[63]

While Goode shared with many of his contemporaries a view that technology ranked beneath science, he believed America could and should correct this discrepancy. America needed proper institutions. Museums, moreover, could be a part of that effort at institutionalization. "That the United States must have a National Museum is so evident that the proposition needs no argument for its support," Goode wrote in 1888. "Every considerable nation has a museum or group of museums in its capital city–centers of scientific and educational activity–the treasure-houses of the nation, filled with memorials of national triumphs in the fields of science, art, *and industrial progress.*" Goode believed that technological and industrial artifacts in the United States served as "legitimate objects of national pride, for upon the character of its museum and libraries intelligent persons visiting a country very properly base their judgment as to the nature and degree of the civilization of the people."[64]

Goode changed museum practice and, in so doing, allowed his views on technology to enter the museum world. According to Frederick W. True, Executive Curator of the USNM in 1896, "the Museum of to-day, owing in part to a natural development and in part to the labors of a few advanced leaders, among whom none have rendered more important service than the late Dr. Goode, is no longer content with a passive existence."[65] Part of the new "active" existence for museums included dealing with the fluid, changing ideas of technology and industry. However, even with Goode's attention to technology, problems remained. Goode still thought of technology

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[63]Goode, "History of American Science," 213. Goode mentioned the founding of the technical associations in the United States. "The American Society of Civil Engineers, founded in 1865, and having in 1893, 1700 members. The American Institute of Mining Engineers, founded in 1871, and now having 2500 members. The American Society of Mechanical Engineers, founded in 1880, and now with 1709 members. The American Institute of Electrical Engineers, founded in 1886, and now with 700 members. . . . The American Institute of Mechanical Engineers, founded in 1880 by Henry Rossiter Worthington (1817-1880) and Alexander Lyman Holley (1832-1882), is another association whose object it is to promote the arts and sciences connected with engineering and mechanical construction. Its membership is limited to mechanical, civil, military, mining and metallurgical and naval engineers and architects" (213-4).

[64]Goode, "Report upon the Condition and Progress of the US National Museum during the year ending June 30, 1888," *USNM Report, 1888,* 6. Emphasis added.

[65]Frederick W. True, "An Account of the U. S. National Museum," in *USNM Report, 1896,* 308.

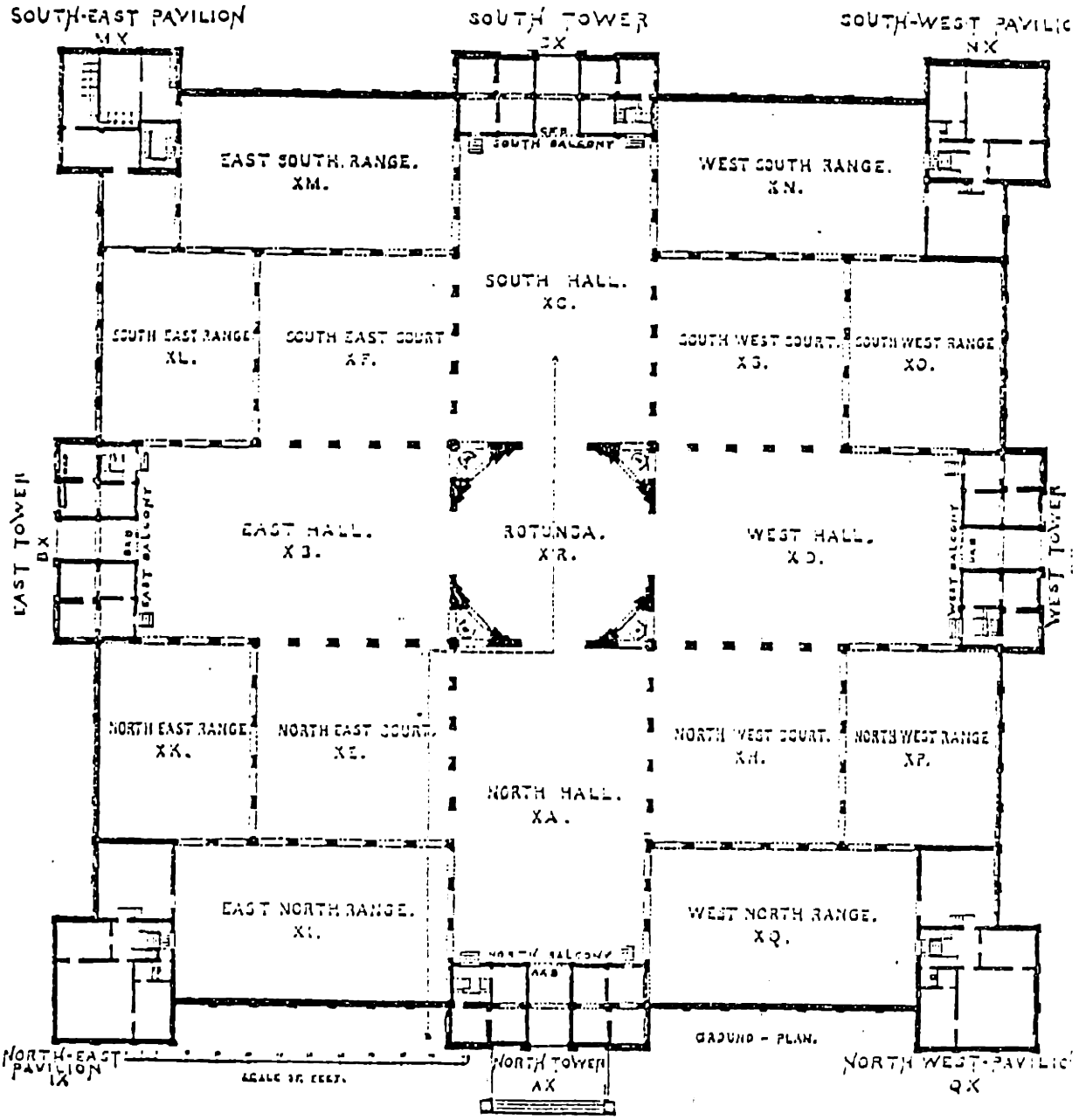
as part, albeit a neglected part, of anthropology, a "high" science. Goode opened a door and let in a man who would spend his life trying to rectify that neglect. J. Elfreth Watkins entered the museum world to broker the culture of technology and technologists.

FIGURE 1.

George Brown Goode.
[From "Memorial of George Brown Goode," *USNM Report, 1897.*]

FIGURE 2.

Floor Plan of National Museum, circa 1882.
[From William J. Rhees, *Visitor's Guide to the Smithsonian Institution and National Museum, Washington, DC,* 1882.]



GROUND PLAN OF THE NATIONAL MUSEUM.

CHAPTER 4

Gathering Steam for the Collection of "Epoch-Making Inventions": John Elfreth Watkins and Technology at the USNM, 1884-1892

In the 1880s and 1890s, engineers, particularly railway engineers, pushed technology as an important part of US culture that needed to be preserved alongside other cultural and historical objects in museums. These pushes from the cultural milieu outside the nineteenth-century museum world forced the development of technology collections on the USNM, often over the objections of the museum's administrators. John Elfreth Watkins (1852-1903), a railway engineer, served as a conduit into the museum world. Continued lobbying on the part of the engineering profession, both with the museum and the US Congress, aided Watkins in brokering a place for engineering and technological culture. His presence and perseverance negotiated a place for technological collections which "slipped in the back door" of the USNM. [See Figure 1 for portrait of Watkins.]

Pennsylvania Railroad and the Entry of Technology into the National Museum

The technological collections as a distinct entity at the USNM began with the work of J. Elfreth Watkins in 1884-1885, under George Brown Goode's direction. Watkins had worked as a railroad engineer but became interested in the history of the railway and the mechanical arts in the United States. When Goode became acquainted with Watkins' interest and expertise, he invited him to become Honorary Curator of Transportation at the USNM. Watkins accepted the invitation in 1884 and attempted to begin developing a transportation collection.[1] Although Watkins now ostensibly had a place inside the museum establishment, his main support remained outside the museum. He consequently mediated between the two communities.

Watkins began his career as a professional engineer. Even after he began work for the USNM, he continued to use the initials C. E. after his name to indicate his status as a civil engineer. Watkins had worked as a mining engineer with the Delaware and Hudson Canal

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[1]For information on Watkins, see Dr. Benjamin, "For the Press [Obituary of Watkins]," SIA, RU 55, Assistant Secretary in Charge of the USNM (Rathbun), 1897-1918, Records, Box 12, General Correspondence, Folder 7, Waldren - Watkins.

Company from 1871 to 1872. In 1873, he became an assistant engineer for construction for the Pennsylvania Railroad Company. In that year, an accident disabled him. He lost his right leg, and he could no longer do field work. He then became chief clerk for the Camden and Atlantic Railroad and later transferred to the Amboy division of the Pennsylvania Railroad. He continued in that position until 1886, although he began work for the USNM in 1885.[2]

In the 1885 *Annual Report,* Watkins first appeared in the organization of departments for the National Museum. The report listed Watkins as an "honorary" (that is, unpaid) curator for the section of Steam Transportation in the Department of Arts and Industries. Only nine of twenty-four National Museum curators received salaries from the Museum in 1885. However, while most of the other unpaid curators received salaries from other government agencies, Watkins' only salary came from his position with the Pennsylvania Railroad Company.[3]

Watkins' continued connection with the Pennsylvania Railroad hurt his work at the USNM by consuming time, but this connection also aided his early collecting activity. In Watkins' view, the connection "made it possible for me to make a most interesting collection of rail sections, which I shall deposit in the Museum as soon as space for the purpose can be assigned."[4] In 1885, Watkins wrote to Goode that people at Pennsylvania Railroad felt "a great interest in this new Department," and he "was assured yesterday by several of our Officers that they would render all possible aid to make it successful in every way."[5] On a trip to Europe in 1886, Watkins worked both for the museum and for the Pennsylvania Railroad while visiting museums and railway companies.

While Watkins' colleagues at the Pennsylvania Railroad supported Watkins' efforts, they also seemed to believe that these efforts might not be successful. In 1887, the Superintendent of the Pennsylvania Railroad wrote to F. Wolcott Jackson, the railroad's General Superintendent,

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[2]"Necrology," *USNM Report, 1904,* 57.

[3]See "Organization of Departments," *Annual Report, Smithsonian Institution, 1885,* 29. The other curators paid by government agencies included four from the US Fish Commission, two from the US Army, one from the US Navy, five from the US Geological Survey, and one from the Bureau of Ethnology.

[4]"Review of the Year's Work in the Scientific Departments, Division of Anthropology, Dept. of Arts & Industries," *USNM Report, 1887,* 79.

[5]J. Elfreth Watkins to George Brown Goode, June 23, 1885, SIA, RU 201, Assistant Secretary in Charge of the United States National Museum, 1875-1902 Letters, Box 15, Folder 2.

regarding Watkins' request for three months leave of absence, to begin January 1, 1888. The Superintendent approved the leave but requested that the way be left open for Watkins to return to Pennsylvania Railroad, in case he found the new position "distasteful."[6]

Struggle for Section of Steam Transportation

According to USNM reports, the Museum officially established the Section of Steam Transportation in June 1885.[7] However, the development of the Section of Steam Transportation remained a continuing struggle. While Goode had established the Section, Watkins had no money and few artifacts. From the beginning, he encountered delays and problems. He complained to Goode, who responded that he remained "absolutely powerless in the matter."[8]

Watkins sought to sway Smithsonian officials to support the transportation section by seeking outside support. As his first step, he lobbied Congress, the source of critical funds. Personnel within the Smithsonian, even Goode, appeared to offer little assistance in this effort to obtain outside support. In April 1886, Goode warned Watkins that "the Director considers it scarcely advisable to use official paper, or to write in an official capacity, in addressing members of Congress upon the subject alluded to by you." Smithsonian Secretary Spencer Baird could not appear to move in the matter himself or to show favorites among collections. Goode urged

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[6]Superintendent, Pennsylvania Railroad, to F. Wolcott Jackson, General Superintendent, Pennsylvania Railroad, November 30, 1887, SIA, RU 297, Box 1, Division of Engineering, 1886-1956, Records, General Correspondence and Outgoing Correspondence, Folder 6, Miscellany, 1887-1890, and undated.

[7]Goode, "Report upon the Condition and Progress of the US National Museum during the half year ending June 30, 1885," *USNM Report, 1885,* 7-8. In 1886, Watkins wrote: "the section of steam transportation was organized and placed under my charge on the 13th of June, 1885." ["Report on the section of Steam Transportation in the U.S. National Museum for the Year Ending June 30, 1886," *USNM Report, 1886,* 119.]

[8]Goode to Watkins, January 7, 1885, SIA, RU 297, Box 1, Division of Engineering, 1886-1956, Records, General Correspondence and Outgoing Correspondence, Folder 2, George Brown Goode, 1886-1891. Goode wrote: "I am exceedingly sorry to have to say that I am absolutely powerless in the matter referred to in your note of Jan. 6. As I explained to you when we talked the matter over last fall, the museum is poor and that we could not undertake any expenditure, in connection with any new department until Congress increased our allowance. What was true then is still true now. Our regular appropriation for 'preservation of collections' from which all salaries, traveling expenses etc. must be paid, is already overburdened to such an extent that we are on the eve of making a considerable reduction in the force, cutting off many indispensable employees. I am sorry indeed that the Museum cannot meet your wishes. I appreciate your situation and your feelings in the matter. I know how enthusiastic you are about the development of your department, and would do anything in my power to help it along. But you yourself will see how impossible it is for an institution to expend money which it does not possess. If Congress increases our appropriations or makes a special appropriation for your department of course that will put things on a different footing. I know you will not consider the Museum any the less interested in your work if, after carefully considering the matter, you will put yourself in the same place."

Watkins that "any necessary letters of this kind addressed to Members of Congress ought rather to come from someone entirely outside of the Museum organization." "Could you not induce some of your Railroad friends who are interested in the matter . . . to take the lead?" Goode asked. According to him, Baird remained "unwilling either by any direct official communication on the subject, or through any of his associates, to put himself in a position where he would undoubtedly subject himself to criticism."[9]

Watkins then consulted with his acquaintances outside the Smithsonian. He enlisted the aid of engineers, mechanics, and important railroad personnel in his efforts with Congress. In May 1886, he wrote to Baird that, through the suggestion of Mr. Randall and Mr. Lockwood (members of the Association of American Master Mechanics and current or previous members of Congress), he would present a petition to the House, through Louis Everhart, US Representative from Pennsylvania. By 1886, according to Watkins, "over thirteen hundred gentlemen connected with railroads in all sections of the United States" had signed the petition and requested "an appropriation to establish a section in the National Museum devoted to the history of the railroad and steam-boat."[10]

With this support, Watkins pointed out to Baird that "the men who have taken the trouble to sign this petition shows how great is their desire to preserve the history of the birth and development of the American Railway and Steamboat from oblivion." "If this can in any way, consistently by you, be brought before the notice of the Committee on Appropriations of the House during the next few days I am sure it would substantially aid the cause," pleaded Watkins. He pointed out that he had substantial support from key people in Congress such as Louis McComas, a member of the House Committee on Appropriations. Watkins noted that Representative McComas had "written a letter to Mr. Sims [Secretary of the Pennsylvania Railroad Company],

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[9]Goode to Watkins, April 19, 1886, SIA, RU 297, Box 1, Division of Engineering, 1886-1956, Records, General Correspondence and Outgoing Correspondence, Folder 2, George Brown Goode, 1886-1891.

[10]Watkins, "Report on the Section of Transportation and Engineering," in *USNM Report, 1886,* 133. Various sources put the number of signatures somewhere between 1000 and 1300. Surviving copies of a printed form of the petition in the Smithsonian Archives contain only between 500 and 600 signatures, but portions may be missing. James Everhart (1821-1888) served as US Representative from Pennsylvania from 1883 to 1887. Daniel N. Lockwood (1844-1906) had served as a US Representative from New York in the 1870s and would serve again in the 1890s. See below for information on Samuel Randall.

expressing a very favorable opinion in regard to the matter, and especially in regard to the character of the signers of the petition." He then asked Baird to make an exception to the general rules and take an active part in soliciting funds for the transportation collection. He stated that even a delay of a single year would seriously impair plans for the Section because the Transportation Exhibition in Liverpool would close soon, and he hoped to obtain artifacts there. In addition, he had made plans for adding other artifacts to the exhibits while on his trip to Europe.[11] Unfortunately for Watkins, Baird continued to refuse to take an active part in negotiations with Congress for the transportation section.

With the suggestions and support of outside people, Watkins began to make notes for "points to be used in advocating appropriation." He believed that "the United States is far behind England, Scotland, France, Germany, and even Italy, in its zeal to preserve the history of the early efforts of the pioneers in Railway and Steamboat building, in which field American inventors have been so successful." According to Watkins, the United States contained within its borders over 120,000 miles of railway, backed by over $7,000,000,000 in capital. Thus, in his view, the country "should preserve its history of this class of invention, which, during the last half century has had such an immense influence upon our growth and the development of our civilization, as well as the other branches of science to which large sums are annually appropriated." He proposed "through the use of models, drawings, relics, &c, to tell the story of steam in such a plain manner that the humble citizen, as well as the expert, may be able to see and understand the steps in the evolution (so to speak) of the locomotive and ocean Steamship of today from their humble beginnings about a century ago."[12] He viewed the railway and the steamboat as quintessentially American and as serving to highlight US history on a par with European historical events.

Watkins continued to experience difficulties accomplishing work in his section at the USNM well into 1886. Discouraged by the lack of progress in the US Congress, he turned again

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[11]Watkins to Spencer Fullerton Baird, May 24, 1886, SIA, RU 201, Assistant Secretary in Charge of the United States National Museum, Letters Received from Departments, Box 15, Folder 3. Louis E. McComas (1846-1907), a lawyer and judge, served as a Republican Representative, 1883-1891, and Senator, 1899-1905, from Maryland.

[12]Watkins, Written notes, SIA, RU 7268, J. Elfreth Watkins Collection, Box 1, General Correspondence, Folder 8.

to Smithsonian officials. In July 1886, he wrote to Baird: "I have received a letter from Senator Sewell in which he states that the outlook for his being able to do anything in the Senate is decidedly unpromising. . . . If it should happen that my efforts should be unsuccessful can you give me any encouragement in regard to the future of our Department? . . . Under the circumstances would you think it advisable for me to withdraw from the Institution entirely?"[13]

Smithsonian officials, including Goode–Watkins' main supporter, continued to be less than helpful. In 1886, Goode wrote to Watkins that he regretted that "the plans for the initiation of your department were not more immediately successful." He reiterated that "I think you know his [Baird's] position in the case," and assured him that "he [Baird] has not any money to spend for any operations in connection with the Liverpool Exhibition." Goode agreed to pay for any "incidental" expenses that Watkins incurred, but he could not "do anything in the way of setting the department on its legs until Congress has made larger appropriations." Goode believed that the Smithsonian would receive $20,000 to $25,000 less than what they had requested from Congress, so there would be no extra money. He tried to add an optimistic note by writing that "I trust that there is light ahead for the department of Steam Transportation, and that before the next Session of Congress some means may be devised for securing proper support."[14] Goode wanted the section, but Smithsonian officials would not use any special effort on its behalf regarding funding. As late as 1890, Goode sympathized with Watkins, writing: "I am sorry that you are disappointed in what has been already accomplished in the Section of Transportation and Engineering." He urged him not to become discouraged but could give him no concrete encouragement regarding the possibilities for funding the further development of his section. Again, he laid blame with Congress, stating that "I do not see how I can make any promises where the expenditure of money is involved; nobody knows what Congress will do with our appropriations; they may be cut down

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[13]Watkins to Baird, July 7, 1886, SIA, RU 201, Assistant Secretary in Charge of the United States National Museum, 1875-1902 Letters, Box 15, Folder 3. William J. Sewell (1835- 1901), a mercantilist, served as Republican Senator from New Jersey in 1881-1887 and again in 1895-1901. After the Civil War, he became involved with the railroad industry in New Jersey, and, in 1893, he served as a national commissioner from the state of New Jersey for the Columbian Exposition in Chicago.

[14]Goode to Watkins, July 23, 1886, SIA, RU 297, Box 1, Division of Engineering, 1886-1956, Records, General Correspondence and Outgoing Correspondence, Folder 2, George Brown Goode, 1886-1891.

a great deal; they are sure to be cut down somewhat, as they have been every year." Goode insisted that Watkins had his "sympathy" in the struggle, and he promised that "what can be done, consistently, will be done for the advancement of your Section."[15]

Watkins continued to lobby appropriate members of Congress and appeared to gain some support. "In conversation yesterday with Senator Sewell he showed great interest in the matter," he informed Goode in May 1885. "He thinks that the subject is of the greatest importance and that it should be taken up at once and put into shape as rapidly as possible."[16] In June 1886, Watkins wrote to Baird: "I have this day received from Mr. John C. Sims, Jr., Secretary of the Penna.R.R. to whom the letter was written a communication from the Hon. Samuel J. Randall, in which he states that the memorial forwarded by over 1,000 prominent Railway Officials, asking that our section be placed on a firm financial basis, is now before the Committee on Appropriations, and has been up for discussion."[17] But the effort proved unsuccessful. By July 1886, Watkins revealed that "I had an interview here yesterday with Senator Sewell in regard to the Steam Transportation matter." "He had it again brought before the Appropriations Committee of the Senate on Friday and it was adversely acted upon," he admitted with disappointment. "Senator Sewell assured me that he had gone beyond his ordinary course in this matter having made it a personal request."[18]

Watkins also tried to keep the USNM and Smithsonian personnel in the loop. As a cultural broker, he tried to work within the practices of both the museum community and the outside communities of engineering and the government. Anxious to avoid stepping on any toes, he informed Goode that "the [Senate] Committee are willing to make an appropriation for personal

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[15]Goode to Watkins, March 27, 1890, SIA, RU 297, Box 1, Division of Engineering, 1886-1956, Records, General Correspondence and Outgoing Correspondence, Folder 2, George Brown Goode, 1886-1891.

[16]Watkins to Goode, May 19, 1885, SIA, RU 201, Assistant Secretary in Charge of the United States National Museum, 1875-1902 Letters, Box 15, Folder 2.

[17]Watkins to Baird, June 1, 1886, SIA, RU 201, Assistant Secretary in Charge of the United States National Museum, 1875-1902 Letters, Box 15, Folder 3. Samuel J. Randall (1828-1890), a mercantilist, served as a Congressional Representative from Pennsylvania from 1863-1890. In 1880 and 1884, he ran for the Democratic presidential nomination in both 1880 and 1884. Although, he lost the nomination in both years, he held sway in Congress during the 1880s, particularly as Chairman of the influential Committee on Appropriations from 1875-1877 and 1883-1889. He also served as the Speaker of the House of Representatives from 1875-1890.

[18]Watkins to Goode, July 11, 1886, SIA, RU 297, Box 1, Division of Engineering, 1886-1956, Records, General Correspondence and Outgoing Correspondence, Folder 2, George Brown Goode, 1886-1891.

expenses already incurred by me and has asked me to name an amount to be passed upon." "Would there be any objection to my receiving this amount from the Government under the circumstances?" he asked, wary of the misunderstanding that might occur if he received money without the knowledge of Baird and Goode. He noted that "I would like to have it understood in this connection that the matters were brought to Senator Sewell's notice without my knowledge and his statement to me as to what had been done by the Committee was an entire surprise."[19] While Watkins did receive funds for his expenses, the petition and the struggle in Congress did not end in appropriations for the Section of Steam Transportation.

Watkins continued to struggle for even the official existence of his Section. The Smithsonian offered him little aid but continued to push him to do more for the Section. In 1886, Goode wrote that "I do not know but that you may have become so disgusted by the failure of Congress to act, that you find your interest in the matter waning." He suggested to Watkins that, in order to spark interest in Watkins' work, the Smithsonian should print, in the next annual report, a statement from him "which shall embody your views as to what should be done and what can be done, and also reference to what already has been accomplished." Goode promised that "it will be printed as one of the reports of the curators upon the Museum departments, for we still consider you as one of the Honorary Curators, and your department as in existence."[20] Over a year after Watkins had first begun work on the section, questions still existed as to its future as well as his association with the Museum.

Watkins agreed with Goode that, in order to stimulate interest in his Section, it would be a good idea "to print a rather full statement in the next report of the Museum as to what should be done and what can be done, for the Section of Railways and Steamboats." However, Watkins also

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[19]Watkins to Goode, July 11, 1886, SIA, RU 297, Box 1, Division of Engineering, 1886-1956, Records, General Correspondence and Outgoing Correspondence, Folder 2, George Brown Goode, 1886-1891. Watkins also wrote: "My position in the matter is this -- the funds that I used to go abroad were the proceeds of a note (endorsed by Mr. Barnard my R'y Superintendent) to be paid off in installments. I have lived up to my obligations until I have reduced the note to $800. The total expenses of my trip were $1410 allowance by Pennsylvania RR for special services $300 -- Private expenses for wife, etc. $330, net cost to me $780 -- This does not include anything for personal services for the 77 days I was absent."

[20]Goode to Watkins, November 23, 1886, SIA, RU 297, Box 1, Division of Engineering, 1886-1956, Records, General Correspondence and Outgoing Correspondence, Folder 2, George Brown Goode, 1886-1891.

felt that his duties with the Pennsylvania Railroad did not give him the time to "prepare such a report as I should care to publish over my signature." He pointed out that "the Railroad company very generously permitted me to devote a great deal of time to the Museum from the date that the section of Steam Transportation was established until the last Congress adjourned." The time that Watkins devoted to the Museum caused him to fall behind in his railroad duties. Accordingly, he wrote to Goode in December 1886 that "you say that you have no doubt that 'in good time the matter will come in suitable form'." "Can you give me any idea as to how soon this 'good time' will come? Has the Director included any item in his estimate for next year that can be spent for our section?" he asked. Watkins insisted to Goode that he "zealously" desired a position in which to carry out what he called his "life's work." "Circumstances have put me in possession of information (which I think I can truthfully say, without egotism) equips me fully for the Curatorship of the Section of Steam Transportation," he maintained. He wanted to accomplish things, but he also wanted to be assured of some support for that work. In 1886, he wrote, "I shall be glad to use this information as you suggest as soon as I can feel that if the time consumed is detrimental to my future in the Railway Service I shall have reason to believe that I can look to the Museum with reasonable assurance that the 'good time' in which 'the matter will come in suitable form' will be in the near future."[21]

Watkins' railway ties still remained quite important to him. In the museum world, Watkins represented railway engineering culture and engineering culture in general. He still felt himself to be a part of the railway world as well as of the museum world. "Having spent over fourteen years in the Railway Service I am naturally jealous of what little reputation I have made," he told Goode in December 1886.[22] He continued

> What I do I like to do well and I am fearful that in trying to ride two horses I may fall and lose both. This has led me to abandon the Museum work until I have some DEFINITE understanding with the Museum authorities as to the future of my Section. I feel that after given all of my spare time for over a year to the subject, after traveling thousands of miles and spending a large sum of money, from my

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[21]Watkins to Goode, December 10, 1886, SIA, RU 7268, J. Elfreth Watkins Collection, Box 1, General Correspondence, Folder 9, and RU 201, Assistant Secretary in Charge of the United States National Museum, 1875-1902, Letters, Box 15, Folder 3.

[22]Watkins to Goode, December 10, 1886.

> private purse, and after having obtained the endorsement of nearly 1200 prominent Railway Managers, from all sections of the country, to the scheme, besides the hearty cooperation of the American Society of Civil Engineers, the Railway Master Mechanics Association, and the Franklin Institute of Philadelphia, where I am best known, that I have done my part towards the establishment of this Section.[23]

He pointed out that he had done his part of the negotiation process with Congress. Now came the Smithsonian administration's turn. "Senators and Representatives on the Appropriations Committees of both Houses tell me that the passage of an appropriation for our Section depends *entirely* upon the action of the Director of the Museum, who must give his official sanction to it, and it is the opinion of every Railway man who is acquainted with the facts of the case, that sufficient pressure has been brought to bear upon the Director to lead him to depart from the usual custom of not 'asking for funds for a specific object'," he maintained. "I should be willing and glad to get to work again, but I do not feel that I should be justified in neglecting my railway duties unless I can have some definite understanding as to the future of my Section in the Museum."[24]

Watkins became frustrated by the lack of progress despite the amount of time he invested. He mediated between two sides and two jobs, one on each side. Watkins had made little progress in his lobbying efforts. Moreover, he still had duties for Pennsylvania Railroad, which paid his salary. Goode tried to understand Watkins' commitment to Pennsylvania Railroad, but he also continued to push Watkins to do more and more in his capacity as Honorary Curator. He insisted that he did not want Watkins to prepare the report unless he felt inclined to do so, but he believed that "it would be advantageous to yourself and to the work which you have so much at heart." "I think I appreciate your situation, and would not wish to urge you to do work for the Museum which would interfere with your other pursuits," he maintained. Goode even appeared, at times, to be less supportive than previously. "I am exceedingly sorry you have involved yourself in expense and loss of time in preparation for work in connection with the Museum," he wrote Watkins in 1886, "but I do not see how we can be held in any way responsible, since it was not at our suggestion or request." Goode reiterated that "we went over the whole subject of the possibilities of your work in connection with the Museum long ago, and I do not see that there is

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[23]Watkins to Goode, December 10, 1886.
[24]Watkins to Goode, December 10, 1886. Emphasis added.

anything new to be said. *The Museum authorities cannot make any more definite pledges for the present than they could make a year ago."* Yet, Goode seemed to back off from earlier support. He referred to Watkins' section as a "proposed" one, rather than one that the museum had already established. He pointed out to Watkins that "my notion in the matter concerning which I wrote you, was simply this: that by publishing in the Museum report your plans and propositions, the department which *you have proposed to establish* would acquire a more definite status among the other departments, and that in another year such a report might be used as an argument for an increase of the appropriation."[25]

In 1886, Secretary Baird acknowledged Watkins' concerns, but he responded by writing the Pennsylvania Railroad Company and asking for more concessions on their part. "Mr. Watkins hesitates to continue his services since he feels that the time consumed in such work in the past (having made it necessary for others to perform a portion of his railway duties) has injured his reputation and prejudiced his opportunities for advancement in the Railway service," he wrote to the company. "We hope however that there is light ahead and we feel that Mr. Watkins' withdrawal from this Institution at this time would be a most serious drawback to the successful establishment of the section which will make it possible for us to preserve the history of the Railway and Steamboat in America -- a subject to which Mr. Watkins has devoted much time and attention."[26]

Negotiating Support from the Railway Community

Railway personnel supported Watkins' mediation and brokering in many ways. They gave both general verbal support to Watkins' endeavors and specific support to the collections at the USNM. Indeed, Smithsonian Secretary Spencer Baird described Watkins as "one of the leading

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[25]Goode to Watkins, December 28, 1886, SIA, RU 297, Box 1, Division of Engineering, 1886-1956, Records, General Correspondence and Outgoing Correspondence, Folder 2, George Brown Goode, 1886-1891. Emphasis added.

[26]Spencer Baird to Pennsylvania Railroad Company, December 31, 1886, SIA, RU 201, Assistant Secretary in Charge of the United States National Museum, 1875-1902 Letters, Box 15, Folder 3.

authorities in the country upon the history of railroads and steam transportation," and "endorsed by many of the leading railroad men of the country."[27]

A petition, submitted to Congress and signed by hundreds of the most prominent railway officials in the United States, proved to be the major sign of the support of the railway sector. The petition reads:

> To the Congress of the United States:
> The undersigned, desirous of perpetuating the history of the birth and development of steam transportation (by steam-boat and railway) in America, respectfully petition your honorable body to appropriate such a sum of money as may be deemed necessary to carry out the plans recently adopted for the organization of the Section of Steam Transportation in the U. S. National Museum; said sum to be expended under the supervision of Prof. Spencer F. Baird, Secretary of the Smithsonian Institution and Director of the U. S. National Museum.[28]

[See Figure 2 for copy of petition and signatories.]

Watkins also enlisted the aid of the press in publicizing the support of the railway sector. In 1886, he wrote to reporters at the Cincinnati *Commercial,* the Boston *Herald,* the Hartford *Courant,* and other newspapers.

> I beg leave to forward you here with a copy of the Washington 'Star' of January 16th, containing an interview with me, and a list of the more prominent of over 1100 prominent Railway officials who have signed a memorial to Congress, asking that an appropriation be made to organize the Section of Steam Transportation in the U. S. National Museum. This measure is now before the Appropriations Committee, and I am particularly anxious that the newspapers through out the country shall make the matter public. I think you will agree with me that when men like Charles Francis Adams, Jr., of the U. P. Ry, H. M. Moxie, of the U. P. R, Robert Garnett, of the B & O R. R., Decatur Axtell, of the N. & A. V. R. R., Samuel Sloan of the D. L. & W. R. R., C. M. Deper and H. J. Haydon of the N. W. Cent. R. R., J. Clark of the Ill Cont R. R., Isaac Hinckley of the [Philadelphia, Wilmington, and Baltimore] RR., and last, but by no means least, [George B.] Roberts, Frank Thomson and C. E. Pugh of the Penna. R. R. give their hearty endorsement to this scheme, I cannot be wrong in thinking there must be some virtue in it, and I shall be very grateful if you will give the matter as much publicity as possible.[29]

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[27]Baird, "Report of the Secretary," *Annual Report, Smithsonian Institution, 1885,* 31-2. Emphasis added.
[28]Watkins, "Report on the Section of Transportation and Engineering," in *USNM Report, 1886,* 134.
[29]Watkins to Murat Halstead, *Cincinnati Commercial,* to E. B. Haskell, *Boston Herald,* to Jos. R. Hawley, *Hartford Courant,* all dated June 14, 1886, SIA, RU 297, Box 1, Division of Engineering, 1886-1956, Records, General Correspondence and Outgoing Correspondence, Folder 7, Outgoing correspondence, 1886, July 9, 1891-Sept. 15, 1894.

Despite these efforts, the US Congress did not comply with Watkins' request for support at that session or the next. Yet, the railway industry's support continued. In 1887, Watkins wrote to Goode that "I am much gratified to find that the interest shown by many railroad officials and others when the work was first inaugurated still continues, notwithstanding the fact that it has been found necessary to delay the organization of the section upon the basis commensurate with its importance." Watkins "hoped that the affairs of the Museum will be in such a condition as to permit the inauguration of active work early during the coming fiscal year."[30] Watkins' mediation appeared to be working for the outside forces in the railway and engineering communities better than internally in the museum.

However, by 1888, the petition campaign had still not accomplished its objective. In that year, Watkins wrote to Goode in desperation. "I beg leave to enclose you herewith a printed duplicate showing some of the signatures to the petition which was presented to Congress in the winter of 1886. Would you advise me to let the matter drop, or do you think it would be well under present circumstances to attempt to get an appropriation for this specific purpose?"[31] Watkins felt that he had failed his colleagues in the railway sector. Continual struggles within the museum institution itself plagued his efforts.

In addition to verbal support, the railroad companies also contributed through physical artifacts. "So far as is known," Watkins observed in 1892, "the important relics now in existence, with very few exceptions, have been deposited in the U. S. National Museum through the coöperation of the officials of railway and steamboat companies." Models joined this relic collection in instances where no one had preserved the originals. "Little thought was given in the early days to the preservation of objects which would now be considered invaluable relics of the early stages of the development of these appliances of transportation upon water and land," Watkins maintained. "The future additions to the transportation collection must, therefore,

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[30]Watkins, "Report on the Section of Transportation in the US National Museum, 1887," *USNM Report, 1887*, 81.

[31]Watkins to Goode, January 11, 1888, SIA, RU 201, Assistant Secretary in Charge of the United States National Museum, 1875-1902 Letters Received from Departments and Bureaus of the Government and Letters Received from Officials of the Museum, Box 15, Folder 5.

necessarily consist of models and drawings of historic objects."[32] The railroad companies funded much of the model construction for use in their own displays at the international expositions. Through Watkins' untiring efforts, the railway companies later donated many of the models to the USNM.

Negotiating Support within the Smithsonian

Smithsonian officials would take what Congress and the railway personnel might offer, but they did not give direct support of their own. Secretary Baird suggested how Watkins might get institutional aid, by suggesting in 1886 that "the way . . . to elicit an official endorsement from the Smithsonian Institution will be for some member of the Appropriations Committee to refer it to the Institution and ask for a report as to its expediency and desirability. I can then say that it has our hearty concurrence and that should the appropriation be made it will be expended in the best possible manner."[33] But the Institution would make no direct request to Congress for financial support of Watkins' section. Baird believed that it would be inappropriate for him to lobby on behalf of a specific section of the Smithsonian.

Baird expected outside effort from both the Congress and the railway sector. In 1886, he wrote to Louis E. McComas of the US House of Representatives: "If the Appropriations Committee thinks fit either to increase the general appropriation of the National Museum or to make a specific allowance to the same, the Smithsonian Institution will take great pleasure in administering the trust with economy and the utmost possible efficiency."[34] At the same time, Baird wrote to John C. Sims, Jr., Secretary of the Pennsylvania Railroad Company, insisting that he sympathized "with the plan of the proposed Division and had already authorized its establishment on such a basis as the Museum can reasonably afford." "If Congress chooses to make the Appropriation, I will then take great pleasure in administering it as effectively as possible

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[32]Watkins, "Report on the Section of Transportation and Engineering," in *USNM Report, 1892*, 127.

[33]Baird to Watkins, May 23, 1886, SIA, RU 7268, J. Elfreth Watkins Collection, Box 1, General Correspondence, Folder 2.

[34]Baird to Hon. L. E. McComas, 1886, SIA, RU 7268, J. Elfreth Watkins Collection, Box 1, General Correspondence, Folder 2.

and with that precedent will continue the estimate year by year," he maintained. He also urged that "persons who feel a special interest in this matter can, of course, use their discretion in bringing it to the notice of Members of Congress and the Appropriations Committee and urging its importance upon each member."[35]

Eventually, Watkins' brokering and negotiation garnered some support from within the Smithsonian, although from an unlikely source. Otis T. Mason (1838-1908), curator of Ethnology, believed in the importance of the preservation of the inventive process. As he put it, "the most profitable inquiry of all is the search for the origin of epoch-making ideas in order to comprehend the history of civilization." The process of invention had "undergone the very same development and improvement as the things invented," and "the commerce of the world is an excellent example of invention affecting men as well as their tools." In 1891, the USNM erected a monument to DaGuerre, the inventor of daguerreotypes. "I do not know that there is another memorial in America to an inventor," Mason remarked on that occasion. "There is no better way to insure for posterity the recollection of this day than by stimulating among the great industries the desire to continue this good work of memorializing their founders." Mason's answer to memorializing inventors equated with Watkins' goal: preserve the artifacts that represented what they had invented. "We can not gather from the four corners of the world the bones of all the great inventors and honor them with a costly burial," Mason wrote. "Even their names have perished from the records of mankind, but their works endure. What better can we do than to gather these and guard them in our great museums, mute witnesses of antiquated arts?"[36]

Mason's interest aided Watkins' efforts, but his connection of invention to ethnology and anthropology also subordinated invention and technology to science. Mason described the industrial arts as falling into six categories:

> (1) Taking the gifts of nature: Man is then a quarryman or miner, a gleaner, a fisherman, a hunter, and later a domesticator.

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[35]Baird to John C. Sims, Jr., 1886, SIA, RU 7268, J. Elfreth Watkins Collection, Box 1, General Correspondence, Folder 8.

[36]Otis T. Mason, "The Birth of Invention," in *Annual Report, Smithsonian Institution, 1892*, 603, 608, 610, 611. See also Otis T. Mason, *The Origins of Invention* (London: W. Scott, 1895; Reprint, Cambridge, MA: MIT Press, 1966).

> (2) Changing the form of natural objects: Man is then a manufacturer, mechanic, artisan, inventor of tools and machines.
> (3) Changing the place or position of himself and of things: Man is then a traveler, a carrier, an engineer, a subduer of forces.
> (4) Intelligent accounting for things and measuring: Man is then a statistician, a measurer, surveyor, guager, weigher, a maker of clocks and almanacs, a scientific explorer.
> (5) The exchanging of the fruits of labor, commerce, business, money: Man becomes a merchant.
> (6) The arts of enjoyment: Man becomes a user of food, houses, furniture, utensils, equipage, fine art in all its branches.[37]

Mason focused on invention as part of the human environment and actions, which was properly the focus of anthropology. In 1889, he described what he considered anthropological exhibits at the 1889 Paris world's fair: "There are one or two attempts to work out elaborative series. The one upon which the greatest attention has been bestowed is Transportation. – 1. In the Air; 2. On land; 3. In the water. The two ideas of riding or conveyance, and carrying, or transportation, are well distinguished." The exhibits covered transportation all the way to the art of ballooning. "The railroad exhibit is also well done," he noted. "The old locomotives are standing on tracks laid in stone beds and there are several very old coaches."[38] Mason considered objects at the heart of Watkins' collections as essentially anthropological in nature.

Negotiating Support from Other Technologists

Watkins also sought support from other "technological" sources beyond the railway world. Most notably, he looked to mechanics and engineers and the new professional organizations they founded. In 1887, at Watkins' request, Secretary Baird issued a circular to these organizations, stating:

> In order to carry out the purposes for which the Section of Steam Transportation in the National Museum was established, it is desired that the co-operation of the various Engineering and other associations interested in the preservation of the history of the American Railroad and Steamboat be obtained. It has therefore been proposed that your association be requested to appoint a committee of one or more of its members interested in the matter, with a view to collecting and preserving in the National Museum such relics, early drawings and other material illustrative of

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[37]Mason, "Influence of Environment upon Human Industries or Arts," in *Annual Report, Smithsonian Institution, 1895*, 643.

[38]Mason to Goode, August 22, 1889, SIA, RU 7068, O. T. Mason Papers, Box 1, Volume I, Letters from Europe written by O. Mason to Dr. Goode and the Mason family, July 17-Oct. 7, 1889.

> the plans of early American Engineers and Railway constructors as may be obtainable.[39]

In 1887, Goode also wrote a letter to participants in the Industrial Parade at Philadelphia from whom Watkins wanted to obtain certain objects for the collection in the Museum that had been gathered for the event. Goode asked for "the generous assistance of all who may be interested in the formation of a national collection which shall represent by original objects, models, drawings, photographs, etc. the progress which has been made in connection with the uses of steam as a locomotive power."[40] This circular and letter, however, went out after Watkins had already been active in enlisting aid from various outside sources.

Watkins attended numerous conventions and professional gatherings. At the American Society of Master Mechanics convention in 1885, he took the floor "to explain to the Association the action of the authorities of the National Museum in creating a Department of 'Steam Transportation, &c'."[41] The Association, in response, adopted the following resolution:

> *Resolved,* That the American Railway Master Mechanics' Association has learned with great pleasure of the establishment by the Directory of the National Museum of the department of steam transportation (both railway and steam-boat), for the purpose of collecting and preserving materials which will illustrate the railway history and its development in this country. This association hereby heartily indorses [sic] the action referred to, and recommends that the members, as far as they can, assist Mr. Watkins, the curator in charge, in making such collections as will fulfill the purpose for which the department has been established.[42]

Watkins continued to mediate between groups. Once the American Society of Master Mechanics had made a move, it was the National Museum's turn. Watkins wrote Goode that his remarks were "so favorably received, and so much good will was expressed by the various members of the association that I think it would be well for the Authorities of the Museum to take

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[39]Baird, February 1887, SIA, RU 297, Box 1, Division of Engineering, 1886-1956, Records, General Correspondence and Outgoing Correspondence, Folder 6, Miscellany, 1887-1890, and undated.

[40]Goode to Whom it may concern, September 14, 1887, SIA, RU 297, Box 1, Division of Engineering, 1886-1956, Records, General Correspondence and Outgoing Correspondence, Folder 2, George Brown Goode, 1886-1891.

[41]Watkins to Goode, June 23, 1885, SIA, RU 201, Assistant Secretary in Charge of the United States National Museum, 1875-1902 Letters, Box 15, Folder 2.

[42]Watkins, "Report on the Section of Transportation and Engineering," in *USNM Report, 1886,* 123. See also SIA, RU 7268, J. Elfreth Watkins Collection, Box 1, General Correspondence, Folder 8.

some action, in acknowledgment of this courtesy."[43] At the American Society of Civil Engineers (ASCE) annual convention in Maryland, in June 1885, Watkins distributed a circular that requested donations of "parts of locomotives, cars, steam-boats, track, etc., as may be of historic value." At this convention, Watkins also took the floor to address the members on the subject of the department of steam transportation. In his opinion, "much interest was manifested by the members, and much individual aid was promised." The ASCE accordingly adopted the following resolution:

> Whereas the authorities of the Smithsonian Institution have established in the National Museum at Washington a department devoted to the preservation of the history of American Engineering Science:
> *Resolved,* That the American Society of Civil Engineers hereby expresses its gratification at the establishment by the Smithsonian Institution, with the authority of the General Government, of a department in the National Museum for the preservation of objects of interest bearing upon the history of American engineering, and recommends that American engineers co-operate with the Smithsonian Institution in furthering the objects for which the Department of Engineering has been established.[44]

The ASCE continued their support and efforts over a number of years. The Franklin Institute of Philadelphia also gave support. In June 1886, the members of the Institute stated:

> Whereas a petition signed by over eleven hundred prominent railway officials of the United States has been presented in the House of Representatives by the Hon. J. B. Everhart, and referred to the Committee on Appropriations, . . .
> Resolved, That the Franklin Institute of the State of Pennsylvania for the promotion of the Mechanic Arts most heartily and cordially concurs in the purpose and objects of this petition, and respectfully requests favorable action thereon.[45]

Watkins sought the support of these groups of mechanics, engineers, and "technologists" at a key point in their history. The ASCE, founded in 1852, was the first professional engineering association in the United States. Other organizations followed it, including the American Institute of Mining Engineers (AIME) in 1871, the American Society of Mechanical Engineers (ASME) in 1880, and the American Institute of Electrical Engineering (AIEE) in 1884. The AIME, ASME, and AIEE all formed from the membership of ASCE. The year 1880 proved to be a key point in

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[43]Watkins to Goode, June 23, 1885, SIA, RU 201, Assistant Secretary in Charge of the United States National Museum, 1875-1902 Letters, Box 15, Folder 2.

[44]Watkins, "Report on the Section of Transportation and Engineering," in *USNM Report, 1886,* 123.

[45]Watkins, "Report on the Section of Transportation and Engineering," in *USNM Report, 1886,* 140. James Everhart (1821-1888) served as US Representative from Pennsylvania from 1883 to 1887.

the professionalization of engineers. Mechanical engineers of the period practiced in many industries such as railroad transportation, machine tools, steel making, and pumping. After the Civil War, university-trained engineers and applied scientists, representing a new institutional community, took over the process of invention and technological change. Railway engineering was no longer "cutting edge" research; it had been routinized and placed in textbooks. Over eighty engineering colleges existed in the United States by 1880.[46] In the year 1882, the first real United States central power plant, Thomas Edison's Pearl Street Station, opened in New York City.

Watkins' Section of Steam Transportation

Watkins, in 1885 and 1886, had clear ideas of what he wanted for the section. "It is intended," he wrote, "to gather in the Museum a collection of objects illustrating the history of American railroads and steamboats, with a view of preserving permanently the memorials of the growth of this most important interest, which has been so closely connected with the material progress of the United States."[47] Watkins also sought to change the audience for the USNM. He wanted to attract the inventor-citizen, the mechanic, and the technologist, as well as the scientist. He designed the section to "illustrate by drawings, models, relics, etc., the birth and development of steam transportation in America, both on water and on land, so that the humble mechanic who visits the Museum may be able to take away with him an intelligent idea of the successive steps in the progress of invention of steam appliances, that have led up to the ocean steam-ship and the fast passenger express and powerful consolidated freight locomotives of to-day." He insisted that the

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[46]For the history of ASCE and other societies see Daniel H. Calhoun, *The American Civil Engineer; Origins and Conflict* (Cambridge, MA: Massachusetts Institute of Technology, 1960); Monte Calvert, *The Mechanical Engineer in America, 1830-1910: Professional Cultures in Conflict* (Baltimore, MD: Johns Hopkins University Press, 1967); Edwin T. Layton, *Revolt of the Engineers* (Baltimore, MD: Johns Hopkins Press, 1986); Raymond H. Merritt, *Engineering in American Society, 1850-1875* (Lexington, KY: University Press of Kentucky, 1969), and Alan Trachtenberg, *The Incorporation of America, Culture and Society in the Gilded Age* (New York, NY: Hill and Wang, 1982). Also see, Chapter 3, footnote 63.

[47]George C. Maynard, "History of the Division of Technology," SIA, RU 297, Box 7, Division of Engineering, 1886-1956, Records, Folder 1, September 1906. Maynard attributed this statement to J. Elfreth Watkins, but the statement appears in Secretary Baird's writings. [See Baird, "United States National Museum, Report of the Secretary," *Annual Report, Smithsonian Institution, 1885,* 31.] The Secretary often based his report on written reports drafted by section heads, some of which remain in the SIA, some of which do not. Watkins' draft reports in existence begin in 1889. [See SIA, RU 158, Annual, Semi-Annual and monthly Reports of Departments of the USNM, 1881-1897, Box 2, Folder 16.]

United States should properly preserve "the history of this department of industry, which has had such an immense influence upon the growth of our nation and the development of our civilization during the nineteenth century."[48] He also believed that the United States in particular needed to develop technological collections. In 1889, he wrote:

> In no country in the world has there been such a revolution in the methods of constructing bridges as in America, yet we are compelled to refuse to exhibit models of the early structures, now rapidly going out of use, owing to the crowded condition of the exhibition series. And the same statement holds good in regard to historic locomotives, cars, and other bulky objects, it being possible to devote only 600 square feet of floor space to the locomotive and railway car. So much progress has been made in solving problems that have risen in connection with electric propulsion, both on land and water, during the last few years, that it would seem proper to begin to collect objects illustrating the early history of the devices which have gradually been developed into the motors, etc., now practically successful and in commercial use.[49]

For Watkins, these technological artifacts had "built" America and, as such, represented key historical artifacts that a museum needed to preserve. When Watkins traveled to Europe in 1886, he gained a favorable impression of the foreign museums, but it left him discouraged by US attempts. In his view, "in our own country with the exception of Fulton, no American inventor of steam appliances has received the meed of praise due him, and yet *no nation in the world owes so much to locomotive and steam-ship inventors and railway constructors as our own.*"[50]

While Watkins held big ideas regarding the conceptual importance of technological artifacts, the physical collection of artifacts under his charge remained small. "The [transportation] exhibit, which is at present small, includes the engine *John Bull* imported from England in 1833 [sic] for the Pennsylvania Railroad Commune, and some objects illustrating the beginnings of the American railroad system," Baird described the section in 1886. Watkins added the *John Bull* locomotive to some few items taken from other departments.[51] [See Figures 3 and 4 for views of

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[48]Watkins, "Report on the section of Steam Transportation in the US National Museum for the Year Ending June 30, 1886," *USNM Report, 1886,* 119.

[49]Watkins, "Report on the Section of Transportation and Engineering," in *USNM Report, 1889,* 299.

[50]Watkins, "Report on the Section of Transportation and Engineering," in *USNM Report, 1886,* 124-29. Emphasis added.

[51]Baird, "Report of the Secretary," *USNM Report, 1886,* 12. According to the *Washington Star:* "The 'John Bull' engine, the locomotive brought to this country from England in 1831, and remarkable from the fact that it was in actual continuous service for over thirty years, has been placed on exhibition in the main hall of the national museum, at Washington. . . . It is intended to form a part of a collection in the museum which will tell the

the *John Bull* locomotive.] In Otis Mason's view, the transportation collections at the USNM "had [their] beginning in a pack-mule and an Indian's skiff."[52] Adjoining the locomotive stood a case "in which there are already assembled about forty objects illustrating the beginnings of the American railroad system."[53] According to Watkins, in 1886, "it was not until November, 1885, that any space in the Museum was assigned to this section. In that month the locomotive 'John Bull,' engine No. 1, Camden and Amboy Railroad Company, 1831, was placed upon exhibition." The Museum also received "a section of the original track" described as "a most valuable relic, since it exemplifies the earliest period of the inventions which have since developed into the American system of permanent way."[54]

Watkins' scheme of organization and plan of action for the section included seven items:

> To obtain originals or models of early steam-boats, locomotives, track, cars, etc., with history enough of each to make a label. Show early experimental track and short pieces of various patterns of rail.
> To obtain drawings or photographs of early steam-boats, locomotives, etc.
> To issue a circular letter to be forwarded to engineering and scientific societies, railway officials and employés [sic], urgently requesting their co-operation and suggesting the formation of a National Railway Historical Society.
> To issue a bulletin with general history of steam-boats and locomotives.
> To create a sectional library.
> To show a general history of transportation: pack horses, freight wagons, stage coaches, canal boats, post boys, mail coach, etc.
> To show by models, drawings, and relics the development of the stationary steam-engine and the beginning of invention of the steam-boat, locomotives, passenger and freight cars, etc.[55]

Watkins' original plans for the Section included steamboat models, engravings of "the important steamboats that have navigated our American waters," the progress of the stationary

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story of the development of steam as a motive power in transportation. This department of the museum is in charge of J. Elfreth Watkins, C. E., of Camden, New Jersey. In accordance with the general design of the museum, the section of steam transportation will exhibit, by means of models, drawings, or, as in the case of the 'John Bull' engine, originals, a complete history of the growth of the railroad and steamship." ["The Story of Steam, as It will Be Told by One of the National Museum Collections," *Evening Star,* Washington, DC, Jan. 16th, 1886, in SIA, RU 7268, J. Elfreth Watkins Collection, Box 1, Folder 16.] Curator George Maynard later wrote: "In making the first installations of transportation exhibits, Mr. Watkins gathered a number of specimens from other departments of the Museum and placed with these the objects collected by him. Some of the specimens were subsequently returned to the departments from which they were taken." [George C. Maynard, "History of the Division of Technology," SIA, RU 297, Box 7, Division of Engineering, 1886-1956, Records, Folder 1, September 1906.]

[52]"Watkins Dined, His Associates in the National Museum Say Farewell," *Evening Star,* 1893, in SIA, RU 7268, J. Elfreth Watkins Collection, Box 1, Folder 20.

[53]"United States National Museum," *Annual Report, Smithsonian Institution, 1886,* 36.

[54]Watkins, "Report on the Section of Transportation and Engineering," in *USNM Report, 1886,* 121.

[55]Watkins, "Report on the Section of Transportation and Engineering," in *USNM Report, 1886,* 120-21.

steam engine, and locomotives, rails, cars, drawings, and designs of the early railways in the United States–including the *John Bull* and two original rails from 1830 for it to rest on. The *Washington Evening Star* reported that "it is the intention to bring these illustrations up to the present time, so that we will have a correct history of the birth and development of the American railway system during the first half century of its existence."[56] [See Figure 5 for layout of Smithsonian collections and space assigned to transportation, circa 1885.]

The Technological Collections

To develop the section and encourage its growth, Watkins sought artifacts from many sources. According to a later curator of technology collections, "a Section of Transportation was organized in the United States National Museum for the purpose of preparing and assembling educational exhibits of a few objects of railroad machinery which had been obtained both from the Centennial Exhibition held in Philadelphia in 1876 and still earlier as incidentals to ethnological collections, and to secure other collections relating to the railway industry."[57] Artifacts came directly from companies, from historical societies, from individual inventors or inventors' families, from the exhibits gathered for the international expositions, and from unknown individuals.

As noted above, circulars went out to various organizations, such as the Constitutional Industrial Parade exhibitors, asking for direct donations.[58] Watkins also asked for donations from his colleagues in the transportation sector. He wrote in 1887: "I shall be glad if those interested in the matter and who have access to old rail piles will collect short sections, say 2 or 3 inches long, of the rails used on the roads in various States during early times and preserve them for future reference."[59] Watkins also spent much of 1886 "in correspondence with railroad officials and

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[56]"The Story of Steam, as It will Be Told by One of the National Museum Collections," *Evening Star*, Washington, DC., Jan. 16th, 1886, in SIA, RU 7268, J. Elfreth Watkins Collection, Box 1, Folder 16.

[57]Carl W. Mitman, *Catalogue of the Mechanical Engineering Collection in the United State National Museum*, Bulletin, United States National Museum, no. 119 (Washington, DC: US Government Printing Office, 1922), 3. Mitman's work will be discussed in Chapter 8.

[58]Goode to Whom It May Concern, September 14, 1887, SIA, RU 297, Box 1, Division of Engineering, 1886-1956, Records, General Correspondence and Outgoing Correspondence, Folder 2, George Brown Goode, 1886-1891.

[59]Watkins, "Report on the Section of Transportation in the US National Museum," *USNM Report, 1887*, 80.

others interested in the development of the section." "From the interest shown," he judged, "the nucleus which we have at the end of the first year of the existence of the Section of Steam Transportation can be rapidly expanded into a collection which shall properly illustrate the history of the birth and development of the steamship and railroad when it shall be practicable to organize the section upon a basis commensurate with its importance."[60]

Watkins continued to correspond with various companies and followed the correspondence up with visits. In 1889, he went to New York and Newark and made the acquaintance of Wyckoff and Seamans of the Remington Type Writer Company. "If the preservation of the history of the development of Writing machines in the U.S.N.M. is desired they will attempt to make the collection on condition that it be deposited then where they had been stored for 20 years," wrote Watkins. "There are over 100, covering the ground from 1796 to 1817 – copies of the Patents (with drawings) destroyed in the patent office fire fill one portfolio." On the same trip, Watkins added to the steam collection. "I think I have laid the way for a prize," he wrote jubilantly to Goode. "The cylinder of the first stationary engine ever used in America has been in custody of the N.J. Historical Society for several years. . . . There is no doubt that the Society would be glad to deposit it in the Museum until their new rooms are built–many years from now."[61]

The USNM participation in world's fairs and other celebrations of the late nineteenth-century also contributed to the collections, although indirectly and less than expected. Funds distributed by Congress to assist with the Government exhibits at various expositions helped to expand the collections. Goode served as the Smithsonian representative for the international expositions at New Orleans, Louisville, and Cincinnati in the 1880s. Upon returning, Goode reported that Smithsonian participation in those three expositions, "although in many respects detrimental to the growth of the Museum, contributed largely to the prosperity of several of its departments." "In the first place, in order that material might properly be selected for exhibition, it was found necessary in many departments of the Museum to employ additional assistants in

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[60]Watkins, "Report on the Section of Transportation and Engineering," *USNM Report, 1886*, 140-141.

[61]Watkins to Goode, December 1, 1889, SIA, RU 201, Assistant Secretary in Charge of the United States National Museum, 1875-1902, Letters, Box 15, Folder 6.

making a thorough overhauling of the material and getting it systematically arranged," he pointed out, and, "in the second place, it was found necessary to purchase a considerable amount of material to fill vacancies in the various series of specimens which were shown at the exhibitions."[62] According to Goode, "the material which is useful for these temporary displays is even more useful for the permanent exhibition series of the Museum."[63] At the Ohio Valley and Central States Exposition in 1888, the USNM spent a total of $4,542.62 of Congressional funding on "new materials completing series, specimens, models, etc."[64] Numerous models in the technology collections had originally been built for display at such fairs, although companies had made most of the models for their exhibits rather than by the USNM for its exhibit. In 1890, Goode wrote to Watkins that "in regard to the purchase of the original boiler of the Stourbridge Lion, I fully agree with you that we ought to have it in the Museum. I hope that if we get what we have asked for in connection with the Chicago Exhibition, we shall be able to buy it. . . . I am keeping a special file of matters to be considered in case all goes well with us for the World's Fair, and have put your letter in this file."[65] The money that the US Congress appropriated for government participation in the fairs sometimes replaced the lack of appropriations for direct purchase. In addition, in 1887, Goode wrote to the US Consul: "During the Constitutional Celebration at Philadelphia great prominence was given to the display of objects illustrating the birth and progress of the American Railroad system during the first Century of the Nation's Existence under the Constitution. Efforts are being made to add these objects to the Collection in the Section of Transportation in the National Museum Collection." Goode provided Watkins' name as a contact for the US Consul.[66]

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[62]Goode, "Exposition Work," *Annual Report, Smithsonian Institution, 1884*, 63. The Smithsonian received $75,000 for New Orleans exhibition, $2,500 for Louisville, and $2,300 for Cincinnati. Most of the funds went to the prominent departments, such as ethnology.

[63]Goode, "Exposition Work," *Annual Report, Smithsonian Institution, 1884*, 63.

[64]Goode to Samuel P. Langley, May 4, 1889, SIA, RU 201, Assistant Secretary in charge of the United States National Museum, 1875-1902, Letters Received from Officials of the Museum, Box 20, Folder 9.

[65]Goode to Watkins, March 27, 1890, SIA, RU 297, Box 1, Division of Engineering, 1886-1956, Records, General Correspondence and Outgoing Correspondence, Folder 2, George Brown Goode, 1886-1891.

[66]Goode to U.S. Consul, 1887, SIA, RU 201, Assistant Secretary in Charge of the United States National Museum, 1875-1902, Letters, Box 15, Folder 4.

The railway companies continued to be a vital source of support and artifacts for Watkins' collection, which he considered inadequate and built with too little thought and institutional support. Even at the fairs, the railway companies aided a large portion of the work. For example, for the Centennial Exposition of the Ohio Valley in 1888, Watkins received aid from the Pennsylvania Railroad and the Baltimore and Ohio Railroad companies and developed an exhibit of the history of land and water transportation.[67]

Watkins' association with outside support culminated in April 1891 with the hosting of the Patent Centennial Celebration, a "series of meetings at which addresses relating to the history and influence of invention were delivered by prominent statesmen, political economists, and engineers."[68] In December 1890, a committee formed to oversee the celebration, and the committee awarded the general secretaryship to Watkins, who wrote that he felt that "a more intimate acquaintance with the inventors of the Country and those interested in the manufacture of patented articles would result in the extension of such of the Museum collections as relate to the development of the mechanic art."[69] During the celebration and associated meetings, Watkins noted that "a loan collection was installed in the Lecture Hall of the National Museum, where machines of antique design, models and early patents were inspected and studied by many visitors drawn to Washington by their interest in the Patent Centennial Celebration." According to the *Washington Evening Star,* the collection included talking machines, telephones, antique electrical railroad, telegraph instruments used by Morse and Vail, photography, a Franklin hand press, musical instruments, typewriters, guns and revolvers.[70] Watkins believed that "the objects relating to the infancy of electric lighting in America are of the greatest interest, and a comparison of the crude sewing machines, typewriters, and other devices recently collected, with the modern achievements of the mechanic's handiwork, is also most striking." He contended that, "since these

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[67]Goode to Langley, May 4, 1889, SIA, RU 201, Assistant Secretary in Charge of the United States National Museum, Letters, Box 20, Folder 9.

[68]Watkins, "Report on the Section of Transportation and Engineering," *USNM Report, 1891,* 166.

[69]Watkins, "Report for FY 1891," SIA, RU 158, Annual, Semi-Annual and Monthly Department Reports, Box 2, Folder 18.

[70]*Washington Evening Star,* April 8, 1891. Article in SIA, RU 158, Annual, Semi-Annual and Monthly Department Reports, Box 2, Folder 18.

relics of invention have proven of great interest to the public, the cooperation of all persons interested is solicited in the extension of the section in this direction."[71] Fortunately for the Museum, "many of the objects that formed a part of this loan collection found a place in the permanent Museum collections," including typewriters from Wyckoff, Seamans and Benedict, and early sewing machines from the Singer Manufacturing Company. Yet, Watkins could not accept all the pieces of this loan collection that he wished due to a lack of space assigned to his section in the Museum. "The limited space that can be assigned to this Section, precludes the acceptance of many objects which the owners would donate or deposit, provided they were immediately placed upon exhibition, but which they prefer not to place in the custody of the Museum to be kept in storage for an indefinite period," he wrote in 1891.[72]

In 1886, Watkins had become a salaried employee of the USNM; yet, duties at the Museum vied for his time with duties for Pennsylvania Railroad. "During the first half of the fiscal year, while serving as honorary curator, I was able, through the courtesy of the officials of the Pennsylvania Railroad Company, to spend such time as could be spared from my duties in their service in the development [sic] of the Section of Steam Transportation," he reported to his superiors. "Owing to the limited time at my command little was accomplished." Once Watkins' association with the Museum became more permanent at the end of 1887, the Institution gave him different space in the Smithsonian buildings and extended the scope of the Section to include Transportation and Engineering, although the overall amount of space did not increase much.[73] [See Figure 6 for space assigned to Transportation and Engineering, circa 1888.]

By 1889, Museum officials had given Watkins some area in the East hall of the Arts and Industries Building. Some of the more prominent items assigned to his section that the museum displayed in the East Hall were a model of Eads' St. Louis bridge, models of the first steamboats used in the United States, plans and designs of locomotives, illustrations of the inventions of

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[71]Watkins, "Report on the Section of Transportation and Engineering," *USNM Report, 1891*, 163.

[72]Watkins, "Report for FY 1891," SIA, RU 158, Annual, Semi-Annual and Monthly Department Reports, Box 2, Folder 18.

[73]Watkins, "Report on the Section of Transportation and Engineering," *USNM Report, 1888*, 107.

James Watt, iron rails, the locomotive *John Bull,* and a full-size model of the locomotive *Stourbridge Lion.*[74]

With the broadened scope of the section, Watkins attempted a new organization. He aimed "to present an object lesson that shall illustrate and preserve the history of the devices man has used, the structures he has built, and the machines he has invented to promote travel and commerce and to convey intelligence."[75] He arranged the new Section of Transportation and Engineering as follows:

(1) Objects and implements for burden-bearing by man and animals;
(2) Objects and implements of human and animal traction (street railway cars excepted);
(3) Originals, models, and drawings of stationary steam-engines;
(4) Originals, models, and drawings of locomotives;
(5) Models and drawings of passenger-freight cars;
(6) Originals, models, and drawings illustrating the development of the American rail and track;
(7) Models, relics, and drawings showing the beginnings of the steam-boat and development of marine steam engineering;
(8) Maps, showing the beginning and extension of the American railway system;
(9) Electrical machines;
(10) Air-ships, etc.[76]

Watkins endeavored to cover the earliest times to the most modern times and inventions. He viewed invention as something quintessentially American that someone needed to preserve and celebrate–in all areas, not just transportation. In 1891, he wrote: "During the last fiscal year the collections in the section of transportation and engineering have been materially strengthened. This is especially so in the branch of mechanical engineering, where it is hoped eventually to secure a series of objects to illustrate the birth and development of the mechanic arts, with special reference to the evolution of the *epoch-making inventions.*"[77]

Watkins' efforts in the arrangement and classification of his department followed synoptic sequences, a popular method of presentation in the USNM. "Since inventive genius has generally

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[74]William J. Rhees, *Visitors' Guide to the Smithsonian Institution and the United States National Museum in Washington* (Washington, DC: Judd & Detweiler, 1889), 89.

[75]Watkins, "Report on the Section of Transportation and Engineering," *USNM Report, 1888,* 107, 108.

[76]"Report upon the Condition and Progress of the US National Museum during the fiscal year ending June 30, 1889," *USNM Report, 1889,* 22-23.

[77]Watkins, "Report on the Section of Transportation and Engineering," *USNM Report, 1891,* 163. SIA, 158, Annual, Semi-Annual and Monthly Report of Departments, 1881-1897, Box 2, Folder 18. Emphasis added.

followed in chronological sequence, the system of arrangement to show development step by step which prevails in the other departments of the Museum is particularly applicable to this section," he wrote in 1888. He also took advantage of the fact that the National Museum had long collected "aboriginal methods of utilizing muscular force and the power of wind and wave." He made objects such as Native American carrying bags and baskets, saddles, dog sledges, river carts, wagons, snow-shoes and toboggans the beginning of a series devoted to transportation. Watkins arranged for the transfer of a number of these objects from the charge of the curator of the Department of Ethnology in early 1888. But Watkins also extended the transportation series to its natural culmination in the "machines and structures devised by the modern engineer to accelerate locomotion and facilitate conveyance."[78] While Watkins' display methods followed traditional museum patterns, the substance of his displays proved unique. He maintained that "in museum administration no similar attempt has previously been made to preserve by monuments the history of the development of appliances that man's genius has contributed towards the creation of the grand chains of intercommunication, the extension of which, link by link, has exercised so potent an influence in accelerating our national growth, increasing our prosperity, and developing our civilization."[79] All told, Watkins had mediated between Smithsonian administrators, other curators, and engineers to develop a small collection acceptable to all – if for different reasons. [See Figure 7 for a photograph of the hall containing the technology collections in the 1880s.] [See Figure 8 for an example of a Synoptic Series in Invention.]

Continued Struggle

Even after the Section's formal establishment and Watkins' assured place as a permanent member of the Smithsonian staff, the technological collections at the USNM continued to struggle and Watkins continued to negotiate and compromise. In 1887, Smithsonian officials had given Watkins a permanent place on Smithsonian staff not by making him a paid curator, but by giving him the position as head of the Department of Property and Supplies, with the title Engineer of

[78]Watkins, "Report on the Section of Transportation and Engineering," *USNM Report, 1888*, 107-08.
[79]Watkins, "Report on the Section of Transportation and Engineering," *USNM Report, 1888*, 108.

Property. His various new duties included "bringing up to date the back records of the office," the "preparation of a complete list of all articles classed as furniture and fixtures," and the preparation of "labels and numbers" for those furniture and fixtures. With the job as Engineer of Property, Watkins no longer served as an "honorary" curator. However, all his salary came from administrative funds, not curatorial funds.[80] His administrative duties now replaced his duties for the Pennsylvania Railroad as obstacles to his attention to the technological collections. Year after year, Watkins' annual report complained about his administrative duties taking away time from curatorial ones.[81] By 1891, the staff list included Watkins under Clerical Staff as Engineer of Property, and not under Scientific Staff, as Curator or even Honorary Curator.[82]

Although Smithsonian staff made great demands on Watkins as Engineer of Property, they did not return the favor with additional support for his efforts on the technological collections. Space remained a continual problem. In 1887, Watkins wrote to Goode that, "judging from the note I received recently from Mr. Geare, I am led to believe very little will be done for the Section of Steam Transportation until a new building large enough to hold our exhibits is completed." "I have already had considerable correspondence in regard to the *Stourbridge Lion,* which Mr. Geare advises me has been donated to us, and I certainly shall feel very much disappointed if I should be

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[80]Goode, "Report upon the Condition and Progress of the US National Museum during the fiscal year ending June 30, 1889," *USNM Report, 1889,* 55-56, 76-77. Watkins, as Engineer of Property and continuing his duties as curator of Transportation, received a salary of $2000 in 1887-88. The salaries of paid curators ranged from $2100 to $2400. [*Annual Report, Smithsonian Institution, 1889,* 36-37.] Watkins' salary came from the "Furniture and Fixtures" appropriation, not the "Preservation of Collections" appropriation.

[81]For example, "the routine work in the Section of Transportation and Engineering has been prosecuted during the fiscal year 1889-90 at such times as my duties in the Department of Property and Supplies would permit." [Watkins, "Report for 1890," SIA, RU 158, Annual, Semi-Annual and Monthly Report of Departments, 1881-1897, Box 2, Folder 17.] In 1887, Watkins complained "during the year, work in the section of Steam Transportation has been conducted during such brief periods and irregular intervals that is has not been possible to make any systematic attempt to increase the collection or to install objects already obtained." [*USNM Report, 1887,* 79.] In the 1890 Annual Report: "Other duties of the curator, Mr. J. E. Watkins, as engineer of property, have prevented him from devoting much time to the development of this collection." [*USNM Report, 1890,* 34.] In his report for 1892, Watkins wrote: "The time of the Curator has been largely taken up by assignment to other duties, hence little attention could be devoted to the Section." [Watkins, "Report on the Section of Transportation and Engineering," SIA, RU 158, Annual, Semi-Annual and monthly Reports of Departments of the USNM, 1881-1897, Box 2, Folder 19.] In 1892, Watkins' duties were further extended to include those of Institution Librarian. "During the first quarter of the fiscal year, the duties of the Curator, while Assistant-in-Charge of the Library of the Smithsonian Institution, engrossed so much of his attention that little could be given to the work in the section of transportation and engineering." [Watkins, "Report on the Section of Transportation and Engineering, 1893," unpublished manuscript, in SIA, RU 18, Box 2, Folder 20.]

[82]"Staff," *USNM Report, 1891,* 22.

compelled to say to Mr. Pugh that we decline to accept the cars, after he has agreed to transfer them to us," he declared. He emphasized that "they would be a most valuable addition to our department and if a question should ever come up, how much interest we would feel if we had some of the original cars that were in use some 50 years ago."[83] Wasted effort also worried Watkins, particularly in view of the fact that the USNM administration never gave his section adequate space or resources. He even used the threat of his leaving in his negotiations for support for his department. In 1887, he wrote to Goode:

> I have recently received a proposition from an Electric Light company, which I think is a very advantageous one, and which if I accept will occupy my full time the next four or five years. I wish very much of course that I could carry out my desire to be permanently located in Washington some day, and ask that you advise me what your personal opinion is in regard to the future of our Section. I do not desire you to think that I am impatient, but you know how much interested I am in regard to the early establishment of our Section. If the space is not to be assigned for our exhibits, of course there will be no further incentive to continue with the work until we have more space.[84]

By 1888, the prospect discouraged Watkins greatly. He wrote to William Cox, Smithsonian Chief Clerk: "while I have tried to keep my spirits up I have felt quite down hearted of late on account of the way things have been going at the Museum. Ten weeks have elapsed since I accepted the position there [as Engineer of Property] and I feel disappointed that I have accomplished so little." He complained of antagonistic, uncooperative staff, and the time he spent trying to "win the esteem of any of my colleagues who might be narrow minded enough to have prejudice against 'a new man'."[85]

Watkins and His Technology

Watkins toiled at the USNM brokering the culture of technology and technologists, of which he remained a part. How did he himself view that culture? First and foremost, Watkins

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[83]Watkins to Goode, November 19, 1887, SIA, RU 201, Assistant Secretary in Charge of the United States National Museum, 1875-1902, Letters, Box 15, Folder 4. R. I. Geare was the Smithsonian Chief of Correspondence and Reports.

[84]Watkins to Goode, November 19, 1887, SIA, RU 201, Assistant Secretary in Charge of the United States National Museum, 1875-1902, Letters, Box 15, Folder 4.

[85]Watkins to William Cox, Smithsonian Chief Clerk, February 28, 1888, SIA, RU 297, Box 1, Division of Engineering, 1886-1956, Records, General Correspondence and Outgoing Correspondence, Folder 1, William V. Cox, Chief Clerk, 1886-1892.

held a "progressivist" view of technology.[86] The history of technology centered on a series of epoch-making inventions and their inventors. It equated the development of technology with societal progress. The idea of invention as something quintessentially American also pervaded his writings and his efforts on behalf of the collections. In notes for a series of "Lectures on Transportation," he quoted the following from an English publication:

> To-day many a foreigner sits down to his breakfast made up of a cereal manufactured at Niagara Falls, a beefsteak from Omaha, a slice of Bacon from the Mohawk valley, and his bread, of course, from American wheat, ground at Minneapolis.
> On his way to his office, if he lives in London, he can ride in a car built in New York, propelled by electrical machinery manufactured at Schenectady, over a railway constructed by American engineers, and largely of American materials.
> On reaching his office and looking about him, he finds, if it is a modern, up-to-date establishment, this condition: he sits in a revolving chair made in Chicago; before a roll-top desk made in Buffalo; his letters are written on a typewriter made at Ilion, New York; he signs with a New York fountain-pen and dries them on a blotting sheet from New England; the letter copies are put away in files manufactured in Grand Rapids.[87]

In his view, the artifacts he collected not only symbolized American dominance in the world arena, they also had built the United States. "There is a nobler era of [American] national development which the railway has made possible," he observed in his "Lectures on Transportation." He maintained that "other nations may possess as much wealth, exert as great a power and enjoy as exalted a civilization as ours, but nowhere upon the face of the globe does mankind partake of the benefits of personal liberty to as great an extent as in free America." Technology brought freedom. "Without the railway and the telegraph (and without the railway there would have been no telegraph) this enviable condition could not have been reached," he insisted.[88]

Watkins also celebrated the role of the engineer and the progress of engineering over time. He wrote in 1898: "Happily for our race and time, the crack of the Egyptian slave master's whip and the weird cries in cadence of battalions of swarthy laborers, while tugging in unison to draw or

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[86]For discussion of "progress talk" in the history of technology, see John M. Staudenmaier, *Technology's Storytellers* (Cambridge, MA: MIT Press, 1985), "What SHOT Hath Wrought and What SHOT Hath Not," *Technology and Culture* 25 (1984): 707-30, and "Recent Trends in the History of Technology," *American Historical Reviews* 95 (1990): 715-25.

[87]Watkins, "Lectures on Transportation," SIA, RU 7268, J. Elfreth Watkins Collection, Box 1, General Correspondence, Folder 21, 52-53.

[88]Watkins, "Lectures on Transportation," 52-53.

hoist the monolith, has given place to the puffing engine and the rumble of revolving wheels." Watkins advocated the history of engineering and the need to remember past advances. He continued:

> Whether the anticipations for the future shall be realized or not, and proud as we may be of the advances made by discovery and invention in our age, we must not forget that the patient perseverance of the engineers of antiquity, who, by brawn and muscle, and unaided by mechanism, built wiser than they knew, have been rewarded by the preservation of an indelible record of their achievements in the material remains of their edifices that have withstood the ravages of the centuries. Will fate so favor the engineer of the nineteenth century, versed in the laws of modern science, and skilled in the practice of the mechanic arts?[89]

At the time that Watkins worked on the museum collections, American railway engineering had reached a stable plateau; it no longer constituted "cutting edge" research. In Watkins' view, "the half century from 1825 to 1875 may be called the experimental era of the American railroad, since the experience obtained during that time has finally led to the adoption throughout the whole country of an almost uniform standard of track construction, depending upon the traffic." Railway engineering in the United States had reached a point similar to engineering in Britain, which was "established" and had societies. Along with this, "there [had] been no great change in the English system of track laying in the last fifty years." From 1825 to 1875, American engineers had been less organized, less experienced, less educated, and had less access to good machine tools and rolling mills. The situation had now changed.[90]

Watkins also supported current advances in technology as well as historical ones. In 1886, he, along with a few others, founded the Philadelphia Typewriter Company, and he served as the company President. Both Romyn Hitchcock, Curator of Textiles at USNM, and Sallie Atkinson, a clerk at USNM, were involved in the company, at least as stockholders. The company began by buying the patents of Bryon A. Brooks, an inventor of improvements to typewriters. For a time, the company also manufactured steam tricycles under the name of the Moto-Cycle Manufacturing Company. Much of the company's business actually dealt with patent disputes. They managed to produce some typewriters in 1894 by hiring the Travis Manufacturing Company to make them

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[89]J. Elfreth Watkins, "The Transportation of Heavy Bodies by the Ancients," in *Annual Report, Smithsonian Institution, 1898*, 619.

[90]Watkins, "Development of the American Rail and Track," in *USNM Report, 1889*, 663, 666.

under contract. Nonetheless, the Philadelphia Typewriter Company ended in 1900 when its stock lost its value.[91] The head of the Travis Company, W. H. Travis, noted in 1901 that the Philadelphia Typewriter Company "got into trouble, was put in the hands of an assignee and the patents and tools were sold."[92]

Although Watkins' history of technology was progressivist and sometimes present-minded, he also began to look at the social and cultural surroundings and the impact of technology. The US Patent Office, holding large numbers of technological artifacts in the form of models, served as a treasury for the student of invention. However, the patent collection consisted only of objects and described little of the context for the inventions represented. According to Watkins,

> the United States Patent Office, where thousands of models, drawings, and descriptions of machines are preserved, is the great repository from which the history of the development of inventive thought may be studied, but the student of the history of invention interested in ascertaining the influence that inventive action has had upon the occupations, habits, and customs of the human race is desirous to examine also the products resulting from this inventive development, especially those that have been put in practical service for the benefit of mankind.[93]

Watkins wanted to "place upon record in the Museum the history of the beginning of the more important American Industrial Arts which have had such an immense influence in the development of our culture, our education, in fact all the characteristics of the progressive American." The Patent Office records alone could not provide this context. The Patent Office, in Watkins' view, contained "only such documents and models as have been presented for examination and adjudication by persons mainly interested in drawing up claims which shall not interfere with the officially recognized inventions of others."[94] Invention and its impact meant far more than that to Watkins who believed that they deserved to be studied alongside other cultural artifacts and

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[91]Philadelphia Typewriter Company Records, 1886-1902, National Museum of American History Archives (hereafter cited as NMAH AC), RU 123, Box 1.

[92]W. H. Travis to Watkins, March 1901, NMAH AC, RU 123, Philadelphia Typewriter Company Records, 1886-1902, Box 1, General Correspondence, January 11, 1893 - May 6, 1902, Folder 5.

[93]Watkins, "Report on the Section of Transportation and Engineering," *USNM Report, 1891*, 163. Also see SIA, RU 158, Annual, Semi-Annual and Monthly Report of Departments, 1881-1897, Box 2, Folder 18.

[94]Watkins, "Report for FY 1895," SIA, RU 158, Annual, Semi-Annual and Monthly Report of Departments, 1881-1897, Box 2, Folder 22.

historical events. However, Watkins' desire to provide historical context to objects placed him farther from the views of the practicing engineers whom he represented.

Watkins' Departure from the USNM

The year 1892 proved key for the technological collections at the USNM. In this year, the Museum gained the assistance of George C. Maynard (1838-1918), Secretary of the American Association of Inventors and Manufacturers, who added specimens to the collection in the areas of electricity and telegraphy. The museum also lost Watkins in 1892 and his enthusiastic lobbying for the collection.[95] When the Pennsylvania Railroad Company offered Watkins the chance to return to work for them on their exhibit for the 1893 World's Columbian Exposition, he left the USNM. The years of efforts at negotiation and mediation had worn him down. He took with him the support of those "technologists," mechanics and engineers outside the USNM, but he left behind the Smithsonian administration. "On October first, 1892," he wrote, "at the invitation of the Pennsylvania Railroad Company, and with the consent of the authorities of the U. S. National Museum, I took charge of the work of organizing and collecting the historical and technical exhibit made by that company at the World's Columbian Exposition."[96]

Watkins still hoped to fulfill his dream of establishing an important collection. However, after many long years of struggle, he had become unsure whether he would ever get a permanent place in the priorities of the USNM. For a time, he hoped that his efforts at the World's Columbian Exposition would build a collection that the USNM could not refuse to accept as important and worthy of effort. In August of 1892, Watkins wrote to Samuel P. Langley, third Secretary of the Smithsonian, and asked for a leave of absence. He resolved to "superintend the preparation of the historical exhibit to be made by the Pennsylvania Railroad Company at the

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[95]Goode, "Review of Work in the Scientific Departments, Division of Anthropology, Transportation and Engineering," *USNM Report, 1892*, 16. Watkins wrote: "The value of the collection of telegraphic apparatus has been greatly enhanced through the enthusiastic coöperation of Mr. George C. Maynard, of Washington, secretary of the American Association of Inventors. During the annual convention of the Old Time Telegraphers' Association their loan collection of telegraph apparatus was, at his suggestion, placed on exhibition in the section, and attracted much attention." [Watkins, "Report on the Section of Transportation and Engineering," *USNM Report, 1892*, 130.]

[96]Watkins, "Report for 1893," SIA, RU 158, Annual, Semi-Annual and Monthly Report of Departments, 1881-1897, Box 2, Folder 20.

World's Columbian Exposition at Chicago." He asserted that he was "led to make this extraordinary application by the fact that in my belief I shall by this means at the close of the exposition be able to add an important collection to the section of Transportation and Engineering in the U. S. National Museum of greater value than my services in the Institution for that time."[97] However, Langley, while supportive of Watkins' efforts, would not give Watkins a leave of absence from his position as Smithsonian Librarian, a position that the Smithsonian had added to Watkins' duties in 1892–on top of those of his curatorship and other administrative duties.[98]

Watkins began to hope that he could start over somewhere else to negotiate a place for his museum of technology. In his opinion, the exhibits gathered at the 1893 Chicago World's Exposition might form the basis of "the most important transportation collection in the world."[99] However, the USNM's role in building that collection had disappeared. As will be seen in the next chapter, after all of Watkins' labors, the Smithsonian officials nearly abandoned the development of technology collections to the new Field Columbian Museum built in Chicago in 1894.

From 1884 to 1892, Watkins strove diligently to broker a place for the technological collections at the USNM, acting as an "engineer-curator." He strove to present at the USNM a general view of the development of technology, especially mechanical technology. By 1890, he had the nuclei of a collection illustrating the history of the bicycle, the stationary steam engine, the steamboat, the locomotive, and the electric telegraph.[100] In 1891, he hoped "eventually to secure a series of objects to illustrate the birth and development of the mechanic arts, with special reference to the evolution of *epoch-making inventions.*" He aimed not just toward the history of invention but toward "ascertaining the influence that inventive action has had upon the occupations, habits,

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[97]Watkins to Langley, August 22, 1892, SIA, RU 31, Box 67, Office of the Secretary (Langley), 1866-1927, General Incoming Correspondence, 1888-1927, Folder 2, July - October, 1892.

[98]Langley to Watkins, October 1, 1892, SIA, RU 31, Box 67, Office of the Secretary (Langley), 1866-1927, General Incoming Correspondence, 1888-1927, Folder 2, July - October, 1892. In 1893, Secretary Langley stated that "Mr. John Murdoch, whose resignation as librarian was referred to in my last report, was succeeded in charge of the library on July 16, 1892, by Mr. J. Elfreth Watkins. Mr. Watkins on October 1, 1892, resigned his position, and on December 1, 1892, Dr. Cyrus Adler, of the Johns Hopkins University, was appointed to fill the vacancy [library]." [*Annual Report, Smithsonian Institution, 1893,* 9.]

[99]Watkins, "Report on the Section of Transportation and Engineering in the U. S. National Museum, 1894," SIA, RU 158, Annual, Semi-Annual and Monthly Report of Departments, 1881-1897, Box 2, Folder 21. Emphasis added.

[100]Watkins, "Report on the Section of Transportation and Engineering in the U. S. National Museum, 1890," *USNM Report, 1890,* 159.

and customs of the human race."[101] Historian Arthur Molella maintains that Watkins was an early historian of technology. This dissertation also argues that Watkins worked at a key period when engineers were just establishing a professional identity and were eager to promote and preserve the history of their work. Watkins' connections to engineering circles outside the museum proved essential, and he represented the culture of engineering within that museum world.

Watkins believed that vast changes in the display of technology had occurred by 1892. Technological display at the 1893 Chicago fair proved almost a "coming of age" for technology as worthy of preservation and presentation. However, this "worthiness" revealed itself only at the international expositions. Watkins' still sought to make that permanent in museums. In 1892, he wrote:

> The recent increase of popular interest in matters relating to the history of transportation is most remarkable, while the recognition of the importance of illustrating this phase of human effort by the managers of American expositions is none the less gratifying. . . . It is indeed a matter of the greatest satisfaction to know that the importance of that place in history which is occupied by the record of the development of the methods of intercommunication through which the national growth has been so greatly accelerated during the century, is thus to receive due recognition. The extent of the collection of transportation exhibits [at Chicago], together with the publications in relation thereto, can not fail to make a permanent and world-wide impression, both upon the visitors who see, and those absent who read of their magnitude.[102]

Watkins had sought to make such impressions more permanent with his ongoing struggle at the USNM. But his efforts to mediate between the world of engineering and museology had apparently failed by 1892. He consequently moved on to Chicago.

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[101]Watkins, "Report on the Section of Transportation and Engineering in the U. S. National Museum, 1891," *USNM Report, 1891,* 163.

[102]Watkins, "Report on the Section of Transportation and Engineering," USNM *Report, 1892,* 131-32. See also, SIA, RU 7268, J. Elfreth Watkins Collection, Box 1, General Correspondence, Folder 15.

FIGURE 1.

John Elfreth Watkins.
[From Benjamin, "For the Press," Courtesy of the Smithsonian Institution Archives, Record Unit 55, Assistant Secretary in Charge of the USNM (Rathbun), 1897-1918, Records, Box 12, Folder 7.]

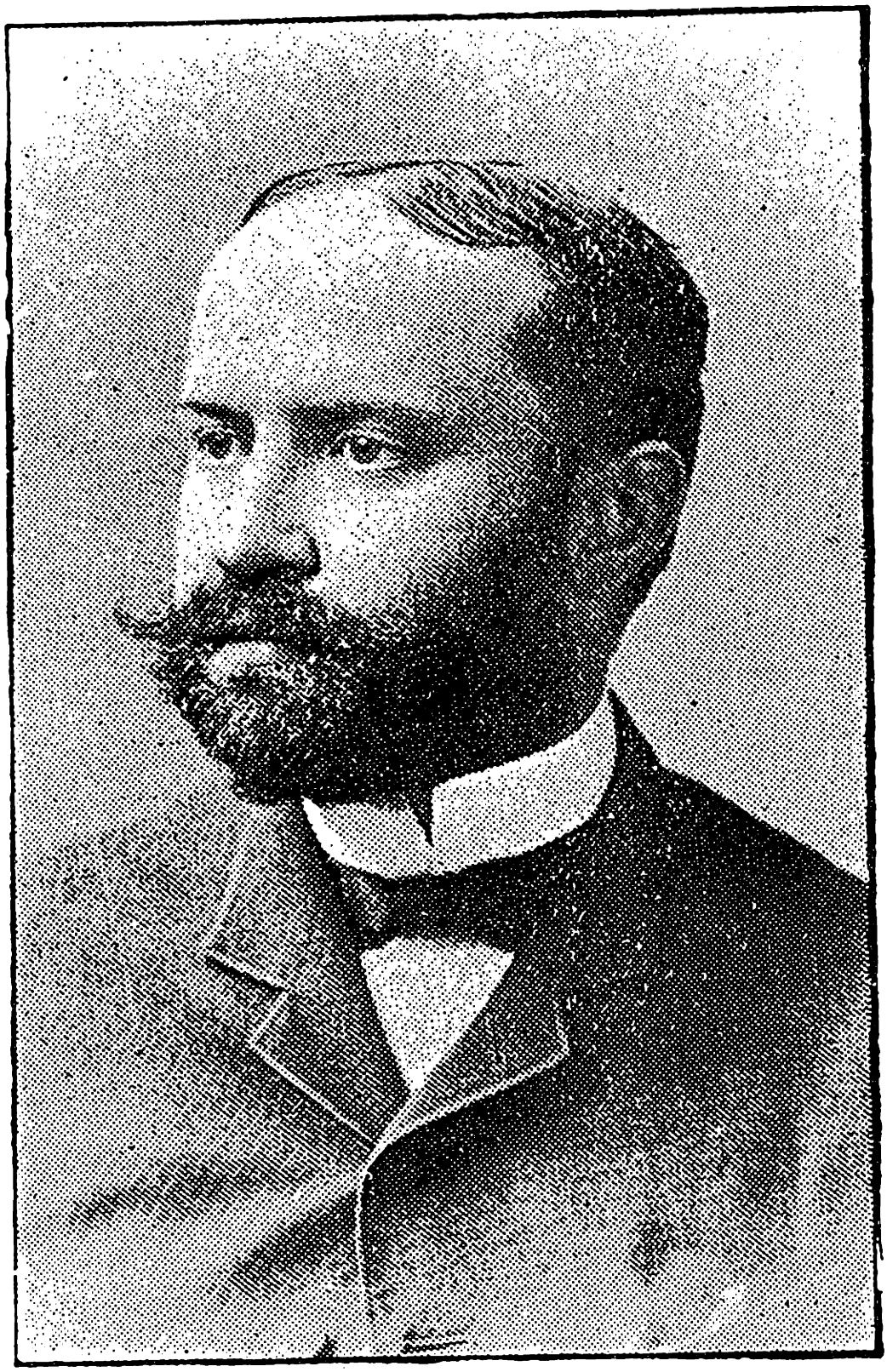

FIGURE 2.

Petition to the Congress of the United States.

[Courtesy of the Smithsonian Institution Archives, Record Unit 201, Assistant Secretary in Charge of the United States National Musem, Letters Received, Box 15, Folder 3.]

To the Congress of the United States:

The undersigned, desirous of perpetuating the history of the birth and development of Steam Transportation (by steamboat and railway) in America, respectfully petition your honorable body to appropriate such a sum of money as may be deemed necessary to carry out the plans recently adopted for the organization of the section of Steam Transportation in the U. S. National Museum. Said sum to be expended under the supervision of Prof. Spencer F. Baird, Secretary of the Smithsonian Institution, and Director of the U. S. National Museum:

Alabama Great Southern R. R.
Charles Schiff, V. Pres.

Alleghaney Valley R. R.
David McCargo, Gen. Supt.
T. R. Robinson, Treas.
E. H. Utley, G. F. and P. A.

Atlantic & Pacific R. R.
H. C. Nutt, Prest.
H. W. Gardiner, Secy.
D. L. Gallup, Audr.

Atlantic & West Point and Western Alabama R. R.
L. P. Grant, Prest.
Cecil Gabbett, Gen. Mangr.
N. M. Abbett, Secy and Treas.

Atchison, Topeka and Santa Fe R. R.
P. F. Barr, Supt.
Chas. Wincheck, Gen'l Foreman.
Edward Flockett, Mast. Mech.
H. V. Farries, Mast. Mech.
R. H. Emerson, Mast. Mech.

Baltimore and Delaware Bay R. R.
J. F. Bingham, Prest.
Fred Gerker, Gen. Mangr.

Baltimore and Ohio R. R.
Robert Garrett, Prest.
F. H. Britton, Supt.
B. F. Luther, Master Mechanic.
E. T. Affleck, D. F. Agent.

Buffalo, N. Y. and Philada.
G. Clinton Gardiner, Prest. and Recvr.
C. H. Allen, V. Prest.
G. S. Gatchell, Gen. Supt.
Jno. Dougherty, Treas.
R. D. McCreary, Engineer.

Boston, Hoosac Tunnel and Western.
A. Kountze, Prest.

Buffalo, Rochester & Pittsburgh.
Walston H. Brown, Prest.
Wm. E. Hayt, Chf. Engr.
Geo. E. Merchant, Gen. Mangr.
I. S. Emery, G. F. A.

Boston and Providence R. R.
Henry A. Whitney, Prest.
A. A. Folsom, Supt.

Bangor and Portland R. R.
C. Miller, Prest.
Geo. W. Mackey, Secy.
E. G. Wire, Chf. Engr.
Chas. N. Miller, G. F. and P. A.

Boston and Bangor S. S. Co.
W. H. Hill, Jr., Gen Mangr.

Burlington, Cedar Rap. and Nth. R. R.
C. J. Ives, Prest.
Robt. Williams, Supt.
S. S. Dorwart, Secy.
H. F. White, Ch. Engr.

Cape Fear and Yadkin Valley R. R.
Julius A. Gray, Prest.

Chicago, Burlington and Northern R. R.
Charles C. Upham, Chief Engr.
J. M. Forbes, Treas.

Cleveland and Canton R. R.
J. W. Wardwell, Gen'l Supt.
Albert Rokusek, G. F. and P. A.

Cincinnati and Eastern R. R.
B. F. Contes, Prest. and Recvr.
H. E. Sawyer, Supt. Trans.
T. D. Rhodes, Treas. and G. P. A.
W. L. King, Chief Engr.
J. C. Horner, Supt. M. P.

Chicago and Alton R. R.
J. H. Parsons, Supt.
C. A. Smith, Supt. Water Works.
J. H. Finney, Asst. Supt.
Jacob Johann, Mast. Mech.
C. H. Mead, Foreman Car Shops.
G. D. Brooke, Gen'l Foreman.

Chicago, Burlington and Quincy R. R.
Henry B. Stone, Gen'l Manr.
J. O. Bosler, Gen'l Supt.
George C. Smith, Chief Engr.
F. C. Rice, Superintendent.
C. N. Rosseguin, Supt.
F. E. Walker, Engineer.
F. J. Allen, Engineer.
R. J. McClure, Cons. Engr.
Thomas Gordon, Divn. Engr.
J. O. Thorne, Brg. and Bldg. Supt.
E. A. Gunnell, L. and. D. Agent.
Wm. Irving, Gen'l Purc. Agent.
R. W. Colville, Mast. Mech.

Cleveland, Akron and Columbus Ry.
J. Monserrat, President.
R. French, Chief Engr.
R. G. Sharp, Supt. Transp.
E. C. Jones, G. F. and P. Agent.

Chicago and Eastern Illinois R. R.
D. R. Patterson, Purc. Agent.
O. S. Lyford.

Chicago, Burlington & Northern R. R.
Geo. B. Harris, Gen. Mangr.
C. C. Upham, Chf. Engr.
A. B. Hinckley, Audr.

Columbus and Cincinnati Midland R. R.
S. P. Peabody, Gen'l Supt.

Cleveland, Columbus, Cincinnati and Indianapolis Ry.
N. H. Devereux, Prest.

Chicago, Milwaukie and St. Paul R. R.
D. J. Whitemore, Chf. Engr.
J. W. Lowry, Gen'l M. M.
E. Fairbairn, Mast. Mech.
A. E. Alcott, Gen'l Foreman.
C. King, Gen'l Foreman.

Central Iowa R. R.
Wm. Hanna, Director.
D. V. Phelps, Asst. Supt.

Cincinnati and Muskingum Valley R. R.
F. G. Darlington, Supt.

Cincinnati Southern Ry.
John Carlisle, Trustee.

Chicago and North Western Ry.
J. E. Blunt, Chief Engr.

Cincinnati, Hamilton and Dayton R. R.
C. C. Waite, V. Prest.
J. Ramsey, Chief Engr.

Chicago, Rock Island and Pacific Ry.
A. Kimball, V. Prest.
C. L. Ewing, Claim Agent.
W. H. Robinson.
George F. Walker, Supt.

Cincinnati, Wabash and Michigan R. R.
Norman Beckley, Gen'l Manr.
O. W. Lamport, Supt.
S. B. Ginker, M. Mechanic.

Cincinnati, Indianapolis, St. Louis and Chicago Ry.
M. E. Ingall, Prest.

Cleveland and Pittsburg R. R.
John Thomas, Superintendent.
R. S. Smith, Assistant Manager.
G. A. Ingersoll, Sec'y and Treas.

Cincinnati, New Orleans and Texas Pacific Ry.
Frank S. Boud, President.
R. Carroll, Gen'l Supt.
G. B. Nicholson, Chief Engr.
G. Bouscaren, Cons. Engr.
James Meehan, Supt. M. P. & M.

Columbus, Hocking Valley and Toledo Ry.
M. M. Green, Prest.
Wm. M. Greene, 2d V. Prest.
William N. Cott, Treasurer,
W. H. Jennings, Engineer.
F. B. Sheldon, Engineer.
J. G. Hutchins, Master Mech.
William A. Miles, G. F. Agent.

Chicago and West Michigan R. R.

J. K. V. Agnew, Gen'l Supt.
J. H. Carpenter, G. F. & P. A.

Delaware, Lackawana and Western R. R.

Samuel Sloan, Prest.

Dayton and Ireton R. R.

Jas. M. Prendergast, Prest.

Delaware and Bound Brook R. R.

J. H. Stevenson, Sec'y and Treas.

Detroit, Grand Haven and Milwaukee Ry. and Chicago and Grand Trunk Ry.

W. J. Spicer, General Manager.
J. W. Fortune, Asst. Gen'l Manr.
Geo. Masson, Chf. Engr.
A. B. Atwater, Supt.
W. J. Morgan, Supt.
J. H. Minor, Treasr.
H. Roberts, Mech. Supt.
John Main, Asst. G. F. Agent.
J. E. Quick, Gen'l Bg. Agent.
J. S. Lorimer, Gen'l Storekeeper.

Duluth and Iron Range R. R.

C. Tower, President.
L. P. Beck, Secretary.
A. H. Viele, Auditor.
R. H. Lee, Chf. Engr., and Supt.
John Mallman, Chief Explorer.

Detroit, Lansing and Northern R. R.

J. B. Mulliken, Gen'l Manr.
F. M. Fish, Gen'l Superintendent.
J. J. McVean, Chief Engineer.
John Doyle, Gen'l R. Master.
B. F. Calvin, Gen'l Road Master.
G. C. Watrous, Supt. M. P.
W. A. Carpenter, G. F. and P. Agt.
G. W. Light, Asst. R. Master.
B. Rustine, Asst. R. Master.
B. M. Tiffany, Foreman Car Dep.
A. P. Sweet, Master Painter.
T. S. Newton, Gen'l Bg. Agent.

East Tennessee, Virginia and Georgia R. R.

J. C. Andrews, Gen'l Sth. Agent.
F. R. Hunger, Superintendent.

Elmira, Cortland and Northern R. R.

A. A. McLeod, Gen. Mangr.

East Tennesee and Western N. C. R. R.

A. Pardee, Jr., Prest.
J. G. Wise, Secy. and Treas.

Fort Wayne, Cincinnati and Louisville R. R.

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Charles Hoffman, Audr.
R. F. Kinnaird, G. F. A.

Florida Southern Ry.

James D. Hallston, Supt.
Sherman Conent, Gen'l Manager.

Flint and Pere Marquette R. R.

H. C. Potter, V. P. and Gen'l Manr.
Sanford Keeler, Superintendent.
William B. Sears, Chief Engr.
W. F. Potter, Assistant Supt.
G. M. Brown, Gen'l R. Master.
H. M. Perry, M. C. Builder.
Thomas J. Matswell, M. M.

Gulf, Colorado and Santa Fe Ry.

M. W. Joyce, Gen'l Agent.
Thomas M. Jackson, Land Agent.
W. J. Sherman, Engr. Rdwy., Brgs. and Bldgs.

Henderson Bridge Co.

S. S. Eastwood, Secretary.

Houston and Texas Central.

A. H. Swanson, Gen'l Manr.
G. A. Quinlan, Engr. and Supt.
E. W. Cave, Treas.

Hanover Junc. and Gettysburg R. R.

A. W. Eichelberger, Prest.
R. M. Wirt, Sec'y and Treas.

Indianapolis, Decatur & Springfield R. R.

H. B. Hammond, Recvr.
G. W. Bender, Supt.

Indianapolis and St. Louis Ry.

T. W. Burroughs, Supt.
W. P. Orland, Asst. M. M.

Illinois Central R. R.

J. C. Clarke, Prest.
R. S. Charles, Treasr.
C. M. Sheafe, Supt.
J. G. Morey, Gen'l Agent.
D. R. Morey, G. F. A.
Jno. M. Turner, Divn. Supt.
J. W. Coleman, A. G. P. Agent.
Wm. Murray, Gen'l Sth. P. Agent.
S. B. McConnico, Gen'l Agent.

Kansas City, Ft. Scott and Gulf R. R.

G. H. Nettleton, Gen'l Manr.
Norman Jones, Gen'l Agent.

Lake Erie and Western R. R.

C. H. Perry, Chief Engr.
D. G. Hill, Gen'l Supt.
W. S. Weed, G. F. Agent.
H. J. Castater, Audtr.
A. D. Thomas, Cashier.
G. W. Smith, G. P. Agent.

Lake Shore and Michigan Southern R. R.

Maitland Porter, Gen'l Supt.
P. P. Wright, Gen'l Supt.
G. W. Steven, Supt. M. P.
Geo. Gallaway, Fore'n Car Shops.
P. J. Clansy, Fore'n Car Shops.
J. S. Graham, M. M.
L. C. Robson, M. C. Builder.
John Kirby, Gen'l M. C.
Norman Totten, L. and C. Dept.
L. C. Higgins, Pur. Agent.

Lehigh Valley R. R.

E. P. Wilbur, Prest.
Charles Hartshorne, V. Prest.
J. R. Fanshawe, Secy.
Wm. Alderson, Treas.
A. W. Stedman, Chf. Engr.
John Taylor, Gen. Mangr.
J. H. Heckman, G. F. Agt.
E. B. Byington, G. P. Agt.

Louisville and Nashville Ry.

A. M. Quarrier, 2d V. Prest.
L. R. Knott, Asst. to Prest.
R. Wells, Asst. to Prest.
C. R. Barnhart, Supt. Transp.
C. W. Gorringe, Gen'l Agent.
F. B. Robson, Road Master.
G. W. Hinmann, Supt. Brgs. and Bldgs.
L. Howell, Supt.
H. W. Bruce, Atty.
Theo. Welch, G. F. Agent.
J. C. Loomis, Master Trains.
James Geddes, Supt.
C. O. Parker, Supt.
J. T. Harrahan, Gen'l Manr.
R. K. Warren, Secretary.
Cushman Quarrier, Comptr.
W. W. Thompson, Treas.
Lyttleton Cooke, Atty.
F. M. Fonda, Asst. Supt.

Louisville, New Orleans and Texas Ry.

W. N. Marshall, Mast. Transp.
J. J. Casey, M. C. Builder.
R. F. Reynolds, Comml. Agent.
E. D. Anderson, M. M.

Michigan Central R. R.

Benj. Douglass, Engr. Brdgs.
J. D. Hawks, Chf. Engr.
A. Torrey, Asst. Engr.
I. P. Morris, Asst. Engr.
W. B. Stillson, Asst. Engr.
A. G. Dailey, Supt. Transp.

Mexican National Ry.

C. A. Merriam, Gen'l Supt.
E. A. Handy, Engr.
J. M. Winslow, M. M.

Minnesota and North Western R. R.

J. C. Fernstorm, Chf. Engr.
Frank Skipwith, Asst. Chf. Engr.
Chr. Nasten, Asst. Engr.
W. J. Wilgus, Asst. Engr.

Milwaukee and Northern R. R.

James C. Spencer, V. Prest.
C. F. Dulton, Gen. Supt.

Milwaukee, Lake Shore and Western Ry.

J. Donahue, Supt.

Missouri Pacific Ry.

H. M. Hoxie, V. Presdt.
Wm. Kerrigan, Gen'l Supt.
D. Brocke, Supt. Transp.

Maryland Steamboat Co.
H. B. Ensign, Presdt.
James E. Byrd, Secty.

Mexican Central Ry.
F. W. Johnstone, Supt. M. P. & M.

N. Y. Central & H. R. R. R.
Chauncey M. Depew, Prest.
Horace J. Hayden, V. Prest.
J. M. Tancey, Gen. Supt.
Theo. Voorhees, Asst. Gen'l Supt.
C. M. Bissell, Supt.

N. Y., N. Haven & Hartford R. R.
C. S. Davidson, Supt.
Otis C. Lackey, M. M.

New York and New England R. R.
Elliott Holbrook, Supt.
L. W. Palmer, Supt.
J. S. Henney, Supt. M. P.

N. Y., Chicago & St. Louis R. R.
D. W. Caldwell, Receiver.
G. H. Spriggs, G. F. & P. A.

N. Y., Lake Erie & Western R. R.
N. J. Murphy, Supt.

N. Y., Penna. and Ohio R. R.
N. T. Wood, Supt.
Aug. Mordecai, Engr.

Northern Central Ry.
Robert Neilson, Gen'l Supt.
A. C. Hippey, Eng. M. W.
E. D. Nelson, Supt. M. P.
S. W. White, Secretary.

N. Y., Phila. and Norfolk R. R.
William A. Patton, V. Pres.
William Cariss, Sec. and Audr.
R. B. Cooke, G. B. Agt.
H. W. Dunne, Supt.
G. W. Russell, Mast. Mech.

Newport News and Mississippi Valley R. R.
R. W. Briggs, Supt. M. P. & M.
John Fitzgerald, M. M.
W. E. Ramsey, Gen'l Foreman.
D. S. Weaver, Gen'l Foreman.

New Orleans and Vicksburg Packet Co.
J. Janney, Gen'l Agent.

Norfolk and Western R. R.
F. J. Kimball, Prest.
W. P. Cosgrove, Supt.

New Orleans and North Eastern R. R.
John Glynn, Jr., Gen'l Agent.

New York, Ontario and Western Ry.
Thomas P. Fowler, Prest.
J. E. Childs, Gen'l Manr.
H. Anderson, G. F. & P. A.
E. Canfield, Supt.
E. Minshall, M. M.

New York, Providence and Boston R. R.
G. H. Griggs, M. Mechanic.

North Pennsylvania R. R.
F. A. Comly, Prest.

New Haven and Northampton R. R.
S. B. Opdyke, Jr., Supt.

Northern Pacific Ry.
T. F. Oakes, V. P. & Gen'l Manr.
J. M. Hannaford, G. F. A.
C. S. Fee, G. P. A.
A. Anderson, Chief Engr.
F. Green, Supt.
J. Blickensderfer, Engr.
F. W. Gilbert, Supt. R. M. Div.
W. A. Garlock, Mast. Mech.

New Orleans Pacific Ry.
E. B. Wheelock, Prest.
Robert Strong, Secretary.

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C. M. Stanton, Asst. Supt.
W. B. Ruggles, Ch. Engr.
W. J. Robinson, G. B. A.
Percy Werner, Gen. Counsel.

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C. L. Lovering, Drtr.
R. W. Turner, Drtr.
C. N. Bliso, Drtr.
John J. Russell, Drtr.
G. A. Gardner, Drtr.
John S. Braghn, Drtr.
Thomas Dunn, Drtr.
Thomas J. Borden, Drtr.

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R. Woelden, Recr. and Gen'l Manr.
J. Brandt, Gen'l Supt.
G. H. Andrew, Second V. Presdt.
E. P. Rogers, G. F. and P. Agent.

Oceanic S. S. Co.
J. D. Speckles & Bro., Gen'l Agts.

Oregon Railway and Navigation Co.
Goodall, Perkins & Co., Gen'l Agents.

Pacific Improvement Co.
F. S. Douty, Secty.

Pacific Coast Ry.
J. M. Fillmore, Manager.

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J. M. Mills, Supt.
A. Feldpauche, Engineer.
L. W. Allibone, Asst. Engr.

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E. B. Westfall, Supt.
Jos. R. Davis, Asst. Engr.
D. H. Lovell, Asst. Engr.
Isaiah Paxon, M. M.
W. L. Holman, M. M.

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W. Hunter, Asst. Engr.
E. F. Smith, Ch. Asst. Engr.
J. V. Smith, Prest. E. Penn. Div.
O. M. Weand, Engr. of Canals.
Geo. Eltz, Supt. Trans.
G. A. Shaffer, Gen. Bag. Agt.
J. Lowrie Bell, Gen'l Traf. Manr.
James Calhoun, Gen'l Frt. Agt.

Peoria Decatur and Evansville R. R.
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R. A. Bunker, Treasr.
H. C. Parker, Traff. Manr.

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H. D. Campbell, Sec'y and Treasr.
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J. Morton Hall, Purc. Agent.
W. M. Flahaven, M. M.
Jos. Johnson, Supt.
J. L. Kirk, Auditor.
C. H. Bassett, G. P. Agent,
J. H. Agnew, Gen'l Fore'n Shops.
M. L. Cromlish, A. G. F. Agent.

Pennsylvania Company.
T. D. Messler, V. Prest. and Comp.
J. M. Kimball, Supt.
G. S. Morris, Supt.
Chas. L. Cole, A. G. F. Agent.
H. W. Byers, R. Master.

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Frank Thomson, 2d V. President.
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John D. Taylor, Treas.
Chas. E. Pugh, Gen'l Man'r.
T. N. Ely, Gen'l Supt. M. P.
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Henry D. Welsh, Director.
H. H. Houston, Director.
John P. Wetherill, Director.
N. Parker Shortbridge, Director.
Wistar Morris, Director.
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R. E. Pettit, Gen'l Supt.
F. Wolcott Jackson, Gen'l Supt.
Jos. Crawford, Supt.
W. N. Bannard, Supt.
Frank Ellmaker, Supt.
O. E. McClellan, Supt.
A. P. Kirtland, Supt.
J. B. Hutchinson, Supt.
Wilson Brown, Supt.
Alfred Walter, Supt.
J. A. Anderson, Supt. Relief Dept.
Frank Sheppard, Supt. M. P.
H. S. Hayward, Supt. M. P.
S. M. Prevost, Genl Supt. Trans.
J. R. Wood, G. P. A.
G. W. Boyd, Asst. G. P. A.
L. P. Farmer, N. E. P. Agent.
Enoch Lewis, Purc. Agent.
W. P. Sargent, Asst. G. Purc. Agt.
F. J. McWade, Genl. Bg. Agent.
R. W. Downing, Comptr.

James Reed, Supt.
M. Riebenack, Asst. Comptr.
John D. Taylor, Treas.
O. J. Geer, Gen'l Agent.
C. S. Worts, Rd. Foreman Engines.
Joseph U. Crawford, C. E.
Samuel W. Latta, Chief Med. Exr.
M. W. Thomson, Engr. M. W.
W. M. Phillips, Supt.
E. F. Brooks, Engr. M. W.

Richmond and Danville R. R.

F. W. Huidekoper, V. P.

Richmond, Fredericksburg and Potomac R. R.

Jos. P. Brinton, Prest.
E. T. D. Myers, Gen'l Supt.
J. B. Winston, Treasr.

Richmond and Allegheny R. R.

Decatur Axtell, Recr. and Manr.
E. R. Leland, Secty.

Rome, Watertown and Ogdensburgh R. R.

H. W. Britton, Gen'l Manr.
W. W. Currin, Supt. Transp,
T. M. Petty, Gen'l Bg. Agent.
F. R. Becker, Chief Engr.
G. H. Hazleton, Supt.
G. C. Gridley, A. G. P. Agent.
T. H. Austin, Tax Agent.
C. L. Martin, Auditor.
E. M. Moore, G. F. Agent.
H. A. Smith, Road Master.

St. Louis, Alton and Terre Haute R. R.

W. Bayard Cutting, Prest.
G. W. Parker, V. Pres. and Gen. Mangr.

St. Louis and San Francisco Ry.

D. W. Nichols, Gen. Supt.
James Dunn, Ch. Engr.
Wm. A. Thoms, Division Supt.

St. Paul, Minneapolis and Manitoba Ry.

E. B. McKennan, Asst. Gen'l Supt.
C. H. Jenks, Supt.
A. Githens, Supt.
Elmer L. White, Secretary.

South Florida R. R.

J. E. Ingraham, Prest.
F. H. Rand, Gen'l Supt.
B. R. Swoope, Supt.
Wilbur McCoy, Auditor.

St. Louis and New Orleans Anchor Line.

J. B. Woods, Gen'l Agent.

Shenango and Allegheny R. R.

J. T. Blair, Prest.
P. E. McCray, Auditor.

Seaboard Air Line R. R.

John C. Winder, Gen'l Manr.

Steam Packet Co.
Seaboard and Roanoke R. R.
Raleigh and Gaston R. R.
Raleigh and Augusta Air Line.
Carolina Central R. R. Co.

William M. Robinson, Prest.

Southern Transportation Co.

A. M. Calliday, Gen'l Agent.

Star Union Line.

John H. Moriarty, Agent.

St. Louis, Fort Scott and Wichita R. R.

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J. H. Richards, Gen'l Atty.
J. W. Dowland, Secty.

St. Paul and Duluth R. R.

W. H. Rhawn, V. Pres.

Shenandoah Valley R. R.

G. R. W. Armes, Treasr.

Southern Pacific R. R.

A. C. Hutchinson, Gen'l Manr.
A. N. Towne, Gen'l Manr.
I. Kruttschnitt, Asst. Manr.
J. H. Willenth, Secty.
J. A. Fillmore, Gen'l Supt.
Wm. Hood, Chf. Engr.
R. H. Crawford, Cont. F. Agent.
E. W. Haw, A. G. F. A.
Wm. H. Mills, Land Agent.
J. G. Schreiver, Traff Manr.
N. B. Kellogg, Asst. Road Master.
W. G. Curtis, Supt. Track.
Wm. T. Lambell, Engr.
J. R. Wilkinston, Insp. Engr.
E. H. Miller, Jr., Secretary.
J. C. Stubbs, G. T. Manager.
Michael Deering, Asst. Engr.
R. H. Pratt, Asst. Gen'l Supt.
Richard Gray, G. F. Agent.
Jerome Madden, Land Agent.
C. J. Wilder, Frht. Audtr.
E. C. Wright, Gen'l Audtr.

Texas and Pacific Ry.

L. A. Shelden, Recr.
Eugene H. Hinton, Comml. Agent.

Texas and St. Louis Ry.

S. W. Fordyce, Recr.
H. G. Arlis, Comptr.
S. B. Fish, Agent for Recr.
H. A. Young, Chf. Engr.

Ulster and Delaware R. R.

J. H. Jones, Gen'l Supt.

Union Switch and Signal Co.

C. H. Jackson, Presdt.

Union Pacific Ry.

C. F. Adams, Jr., President.
S. T. Smith, Gen'l Supt.
J. Blickensderfer, Chf. Engr.
W. W. Fagan, Supt.
O. H. Dorrance, Supt.
J. O. Brinkeroff, Supt.
L. H. Kortz, Supt. Telegraph.
Erastus Young, Auditor.
J. A. Monroe, G. F. Agent.
Thomas L. Kimball, G. T. Manr.
C. S. Stebbins, G. T. Agent.
J. W. Morse, G. P. Agent.

Ulster and Nth. Carolina R. R.

A. B. Andrews, Prest.

Wallkill Valley R. R.

G. M. Graves, Supt.

Westinghouse Air Brake Co.

George Westinghouse, Jr., Prest.

Wheeling and Lake Erie.

C. A. Wilson, Chief Engr.
Joseph M. Hall, G. P. Agent.
A. G. Brown, G. F. Agent.
A. H. Thorpe, Cashier.
W. R. Woodford, Pur. Agent.
Otto Swartz, Asst. Chief Engr.
M. D. Woodford, Recr.
S. H. Ayers, Secretary.

West Jersey R. R.

R. Stretch, Gen'l Express Agent.

Western Maryland R. R.

J. M. Hood, Prest.
John S. Harden, Secty.
B. H. Griswold, G. F. and P. Agt.

Wilmington and Northern R. R.

H. A. Du Pont, Prest.

West Shore R. R.

J. D. Layng, Gen'l Manr.
C. W. Bradley, Gen'l Supt.
D. B. McCoy, Supt.
J. P. Bradfield, Supt.

Western Transit Co.

S. D. Caldwell, Gen'l Manr.

Wabash, St. Louis and Pacific Ry.

Thos. Anderson, Gen'l Foreman.
R. A. Houghton, Road Master.
Geo. F. Bidwell, Asst. Supt.
A. B. Adams, Road Master.
F. Sullivan, Road Master.
G. W. Stevens, Supt.
W. V. Stuart, Atty.
J. S. Goodrich, Master Transp.

Zanesville and Ohio R. R.

James Buckingham, Prest.
Edw. A. Green, Chief Engr.

Chicago, St. Louis and Pittsburg R. R.

C. B. Taylor, Supt.
Leroy Kells, M. M.
Wm. Stewart, G. F. Agent.
Robert Curtis, M. M.
Edw. B. Wall, Supt.
Chas. B. Street, M. M.
Wm. Swanston, M. M.
W. W. Reynolds, M. M.

Woodruff Sleeping Car Co.

John C. Paul, Gen'l Manr.

Pittsburgh Locomotive Works.

F. G. Dickson, Prest.

FIGURE 3.

Locomotive *John Bull.*
[Courtesy of the Smithsonian Institution Archives, Record Unit 95, Photographic Collections, Box 54, Folder 8.]

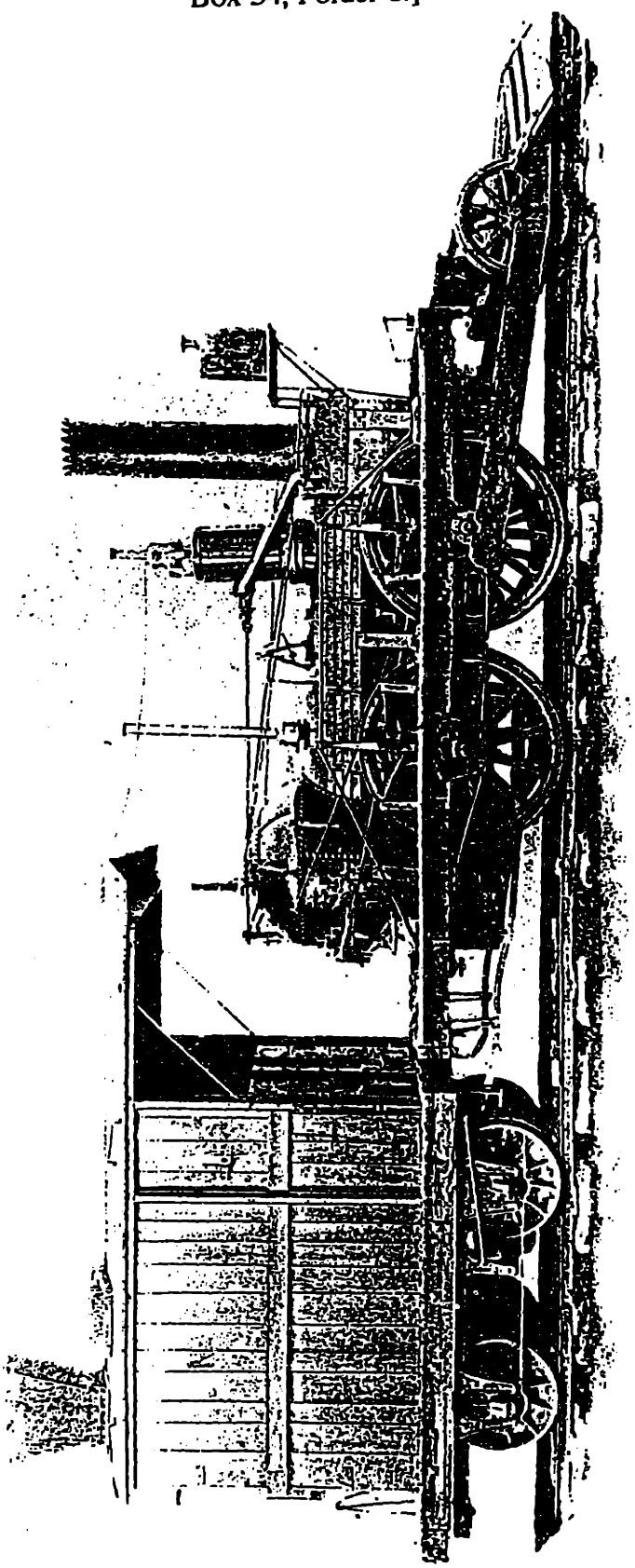
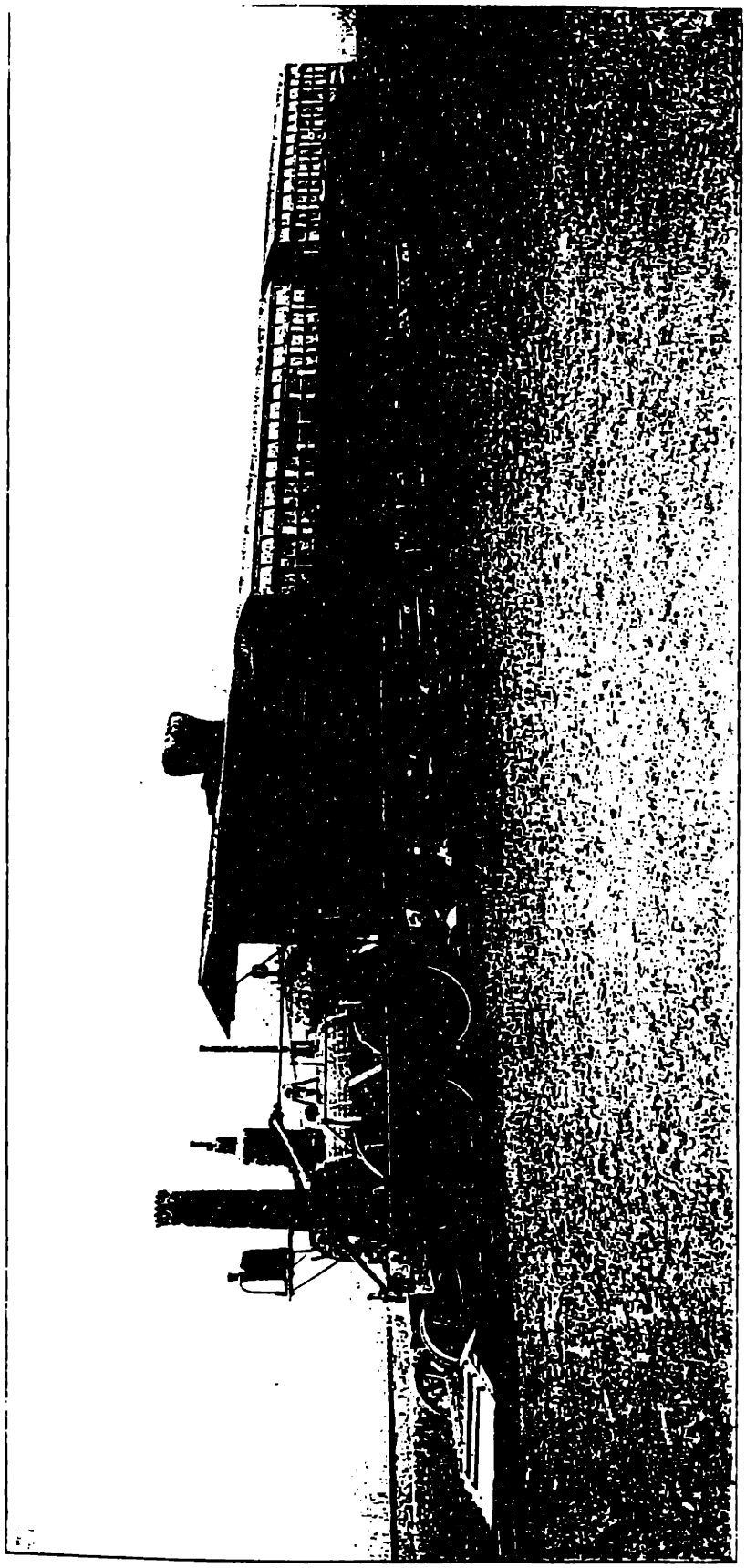


FIGURE 4.

Locomotive *John Bull*, as later displayed at World's Columbian Exposition.
[From *Catalogue of the Pennsylvania Railroad Company Exhibit at the World's Columbian Exposition*, 1893.]



PENNSYLVANIA RAILROAD COMPANY.

THE ORIGINAL LOCOMOTIVE "JOHN BULL" AND TRAIN, 1831.

On Exhibition on Tracks South of Pennsylvania Railroad Building, World's Columbian Exposition. Part of the Historical Collection for which Medal was awarded.

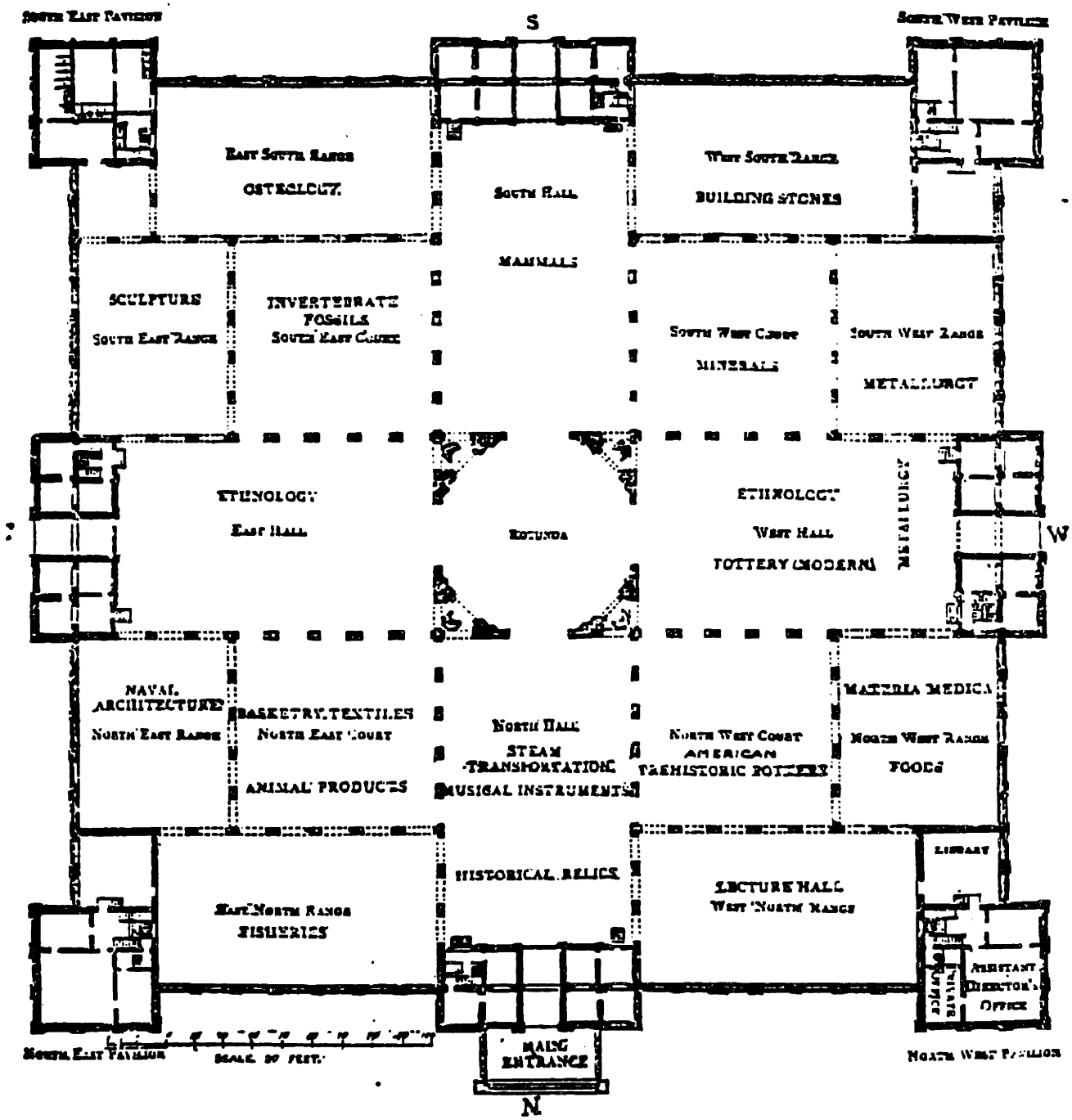
Locomotive No. 1. Built by Stephenson & Company, 1831, for the Camden and Amboy Railroad Company. The oldest complete locomotive in America; shipped from Liverpool, July 11, 1831; first put in service Nov. 12, 1831, at Bordentown, New Jersey, where the Railroad Monument now stands.

This locomotive left New York City under steam April 15, 1891. It hauled the "John Bull" train 292 miles without assistance, to Chicago, arriving April 22, 1891, meeting with a continued ovation over the entire route. It underwent reproduction, but the original engine which went into regular service 1831. It was exhibited at the Centennial Exposition of 1876 and again at the Chicago Exposition of Railway Appliances in 1887. It was then taken to the U. S. National Museum, Washington, where it remained until it was sent to Chicago in April, 1891. There it was one of the great attractions at the World's Fair, carrying over fifty thousand passengers over the exhibition tracks in the Terminal Station yard. The locomotive left Chicago again under steam December 5, 1891, coming east over the Pennsylvania Lines, via the Southwest System, to Pittsburgh and through Altoona, Harrisburg and Baltimore to Washington, making three November 14, 1892. Having made its last trip under steam, it has been returned to the U. S. National Museum, to remain there permanently.

Two Camden and Amboy passenger coaches (type of 1831.) One of these cars is the original car, the body of which was used as a chicken coop at South Amboy, N. J., for many years.

FIGURE 5.

Layout of National Museum Collections, circa 1885.
[From *USNM Report, 1885.*]



PLAN OF THE NATIONAL MUSEUM, WASHINGTON, D. C.

FIGURE 6.

Layout of National Museum Collections, circa 1888.
[From *USNM Report, 1888.*]

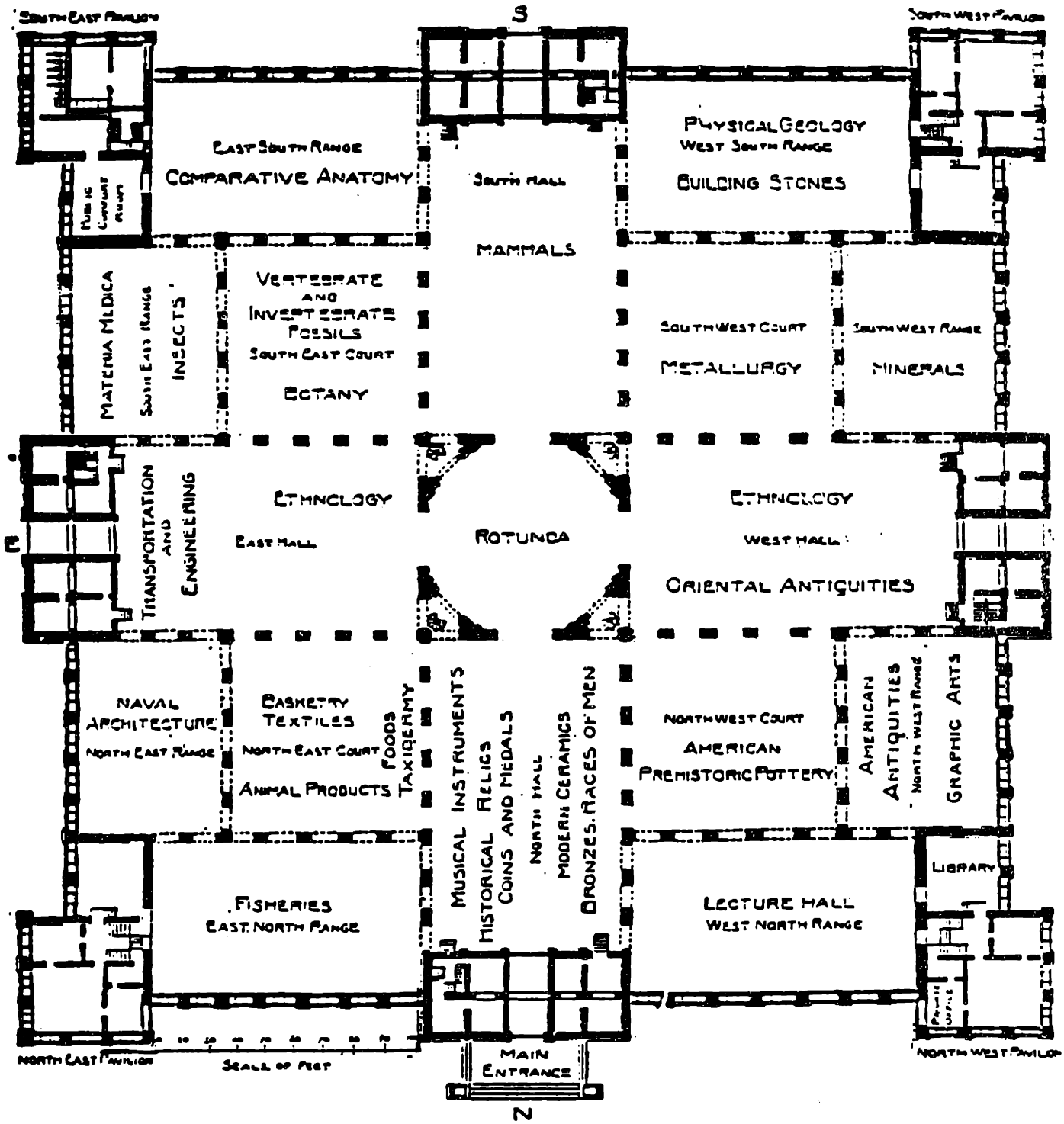


FIGURE 7.

Technology Collections, East Hall, Arts and Industries Building, circa 1880s.
[*John Bull* locomotive in right foreground.]
[Courtesy of the Smithsonian Institution Archives, Record Unit 95, Photographic Collections, Box 43, Folder 27.]

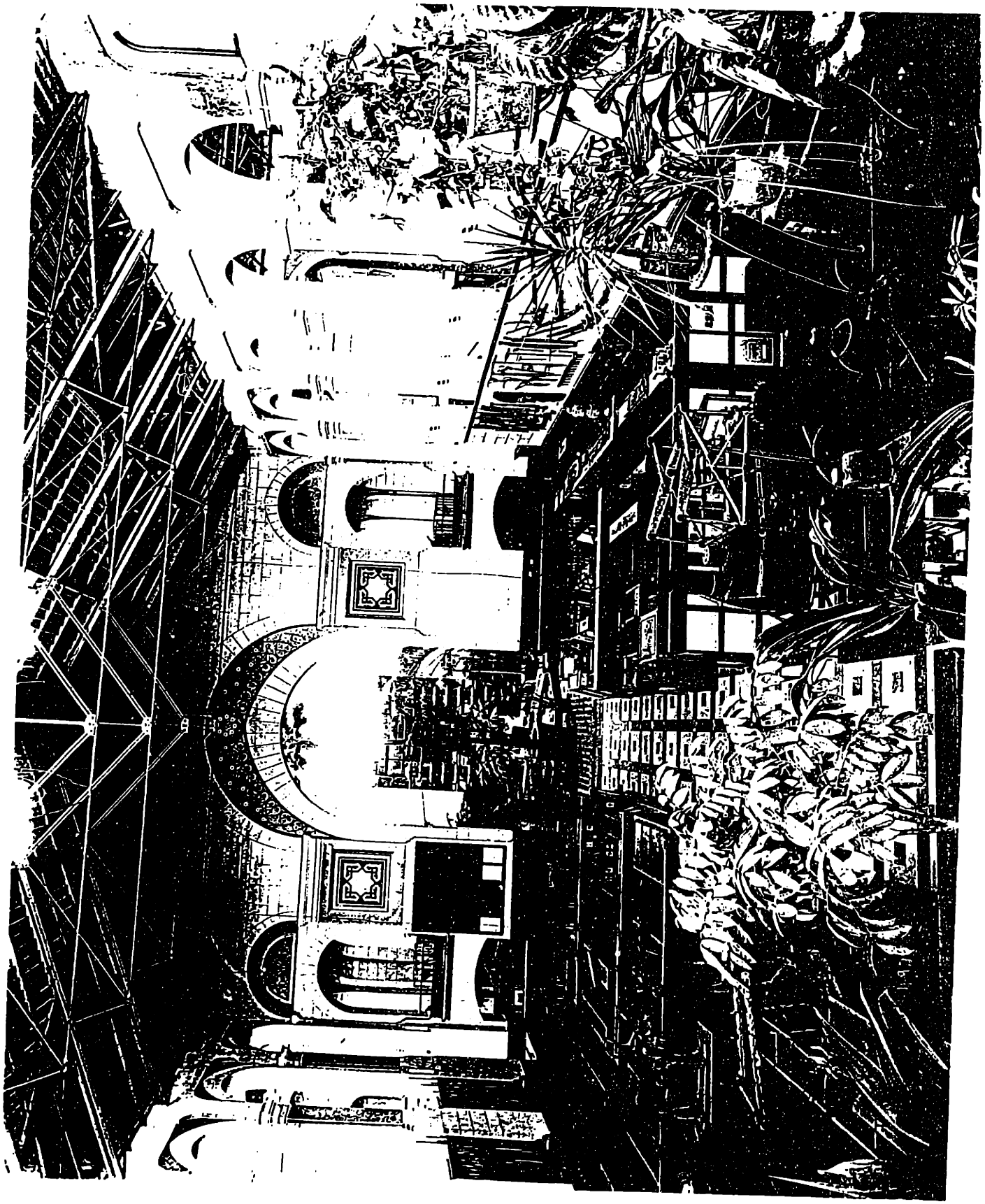
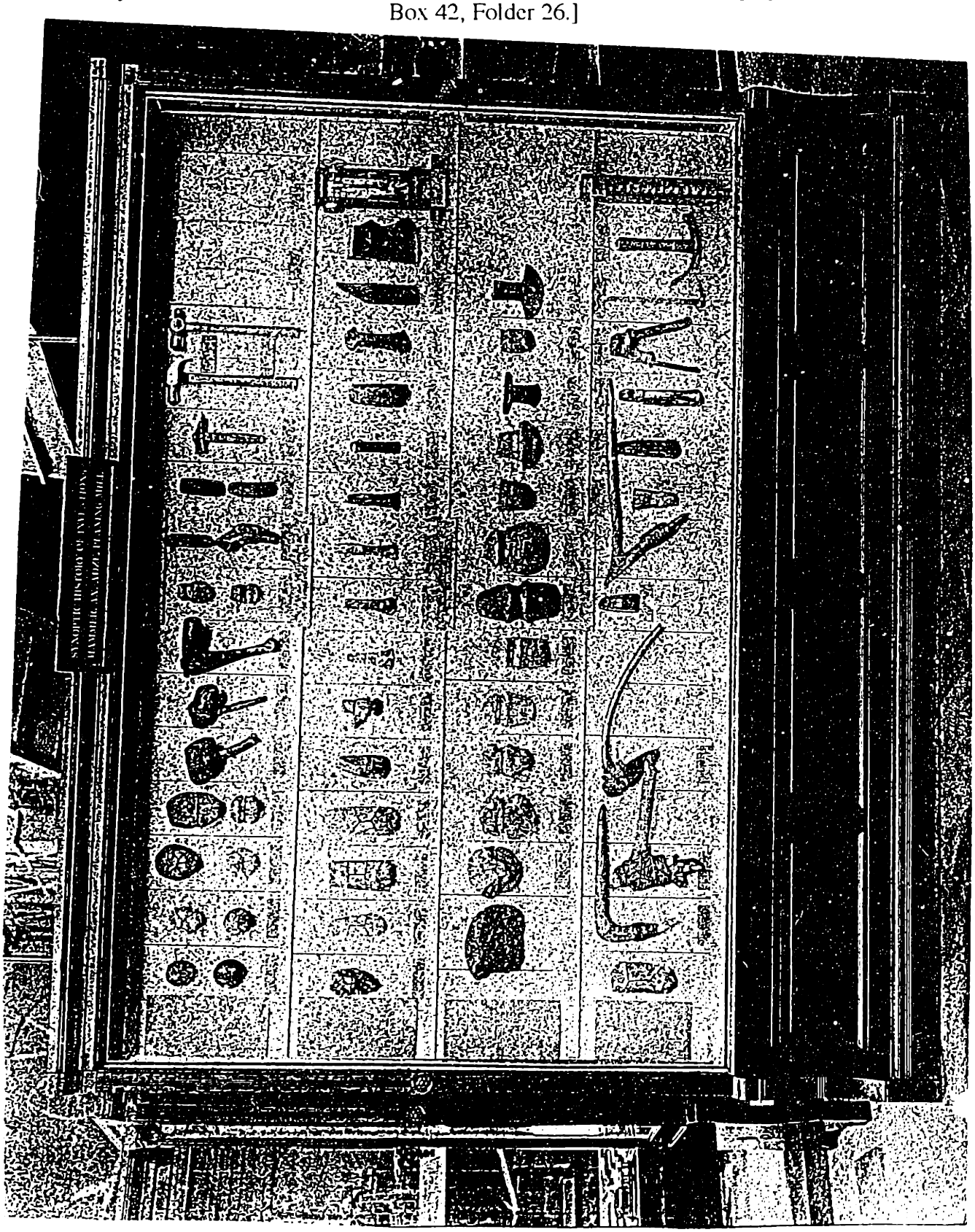


FIGURE 8.

Synoptic History of Invention Display, National Museum Collections.
[Courtesy of the Smithsonian Institution Archives, Record Unit 95, Photographic Collections, Box 42, Folder 26.]



CHAPTER 5

A Place for the "Legion of Strong Angels": Technology, the 1893 World's Columbian Exposition, and the Field Museum

In 1893, Chicago held the World's Columbian Exposition and, from that Exposition, established the Field Columbian Museum, with substantial technological collections. J. Elfreth Watkins played a central role in transferring the technology and transportation exhibits of the fair to the new museum. Major Joseph G. Pangborn of the Baltimore and Ohio Railroad aided Watkins in his efforts. Both men mediated between the outside world of the fair and engineers and the internal museum world.

The World's Columbian Exposition and the Smithsonian Institution

In 1890, the US Congress passed "an Act to provide for celebrating the four hundredth anniversary of the discovery of America by Christopher Columbus by holding an international exhibition of arts, industries, manufactures, and the products of the soil, mine, and sea in the city of Chicago, in the State of Illinois." The act specifically stated that "there shall be exhibited at said exposition by the Government of the United States, from its Executive Departments, the Smithsonian Institution, the United States Fish Commission, and the National Museum, such articles and materials as illustrate the function and administrative faculty of the Government in time of peace and its resources as a war power."[1] Smithsonian officials, however, did not want this responsibility.

George Brown Goode served as the representative to the Chicago Exposition from the Smithsonian and the USNM. In his view, activity in connection with previous expositions had disrupted regular Smithsonian work. In addition to curatorial responsibilities, Smithsonian

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[1]"An Act to provide for celebrating the four hundredth anniversary of the discovery of America by Christopher Columbus by holding an international exhibition of arts, industries, manufactures, and the product of the soil, mine, and sea in the city of Chicago, in the State of Illinois," House, 51st Congress, Session 1, 1889-90, in *Annual Report, Smithsonian Institution, 1890,* xxxv-xxxix, xxxviii.

employees had to prepare, pack and display material without much additional assistance.[2] However, the Smithsonian also received substantial funding in connection with the 1893 Exposition and thus began preparation for an exhibit.[3]

While the USNM clearly prepared exhibits for Chicago, the annual reports remained quiet about the technological and transportation exhibits sent to Chicago. In 1893, Goode wrote that "owing to the sickness of Mr. Watkins we have decided to make no Transportation exhibit."[4] By this time, Watkins was striving to prepare the Pennsylvania Railroad exhibit for the Chicago fair. Before leaving the USNM, Watkins wrote in an annual report that the following items went to Chicago from the USNM: a collection of typewriters, a model of the locomotive *Old Ironsides,* and the *John Bull* locomotive. However, rather than being put in the Smithsonian display, these objects became parts of exhibits by other organizations, such as the U. S. Patent Office and the Pennsylvania Railroad Company.[5] Indeed, the USNM exhibit in the Government Building at Chicago did not include transportation and engineering artifacts. [See Figure 1 for the Ground Plan of the United States Government Building at the World's Columbian Exposition in 1893.]

What is more, the USNM made little effort at the close of the 1893 fair to add to their technological and industrial collections from the large collections gathered at Chicago. In 1894, Smithsonian Secretary Samuel Langley stated that

> it would have been possible to have obtained an immense number of specimens on this occasion, but it was deemed proper to refrain from efforts in this direction, not only because of the considerations just referred to [overcrowding and

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[2]See Samuel P. Langley, "Report of the Secretary," *Annual Report, Smithsonian Institution, 1890,* 23-4.

[3]Sundry Civil Appropriation Act, US Congress, March 3, 1891, *in Annual Report, Smithsonian Institution, 1891,* xliii. See also, *Annual Report, Smithsonian Institution, 1891,* 20.

[4]George Brown Goode to Capt. J. W. Collins, Chief, Division of Fisheries, World's Columbian Exposition, January 27, 1893, SIA, RU 70, Exposition Records, Box 37, Folder 3, Outgoing correspondence of Goode and Earll, 1891-1893.

[5]J. Elfreth Watkins, "Report on the Section of Transportation and Engineering, 1893," unpublished manuscript, in SIA, RU 158, Annual, Semi-Annual and Monthly Reports of Departments of the USNM, 1881-1897, Box 2, Folder 20, Section of Technological Questions, 1-2. All of these items were to be returned to the USNM at the close of the fair. For example, Watkins wrote to Curator-in-Charge Frederick True in 1892 regarding the typewriter collection that was lent. Watkins enclosed a copy of a letter from Wyckoff, Seamans and Benedict, offering to redeposit their collection of typewriters in the Museum, at the close of the World's Fair. [Watkins to True, October 28, 1892, SIA, RU 201, Assistant Secretary in charge of the United States National Museum, 1875-1902 Letters Received from Departments and Bureaus of the Government and Letters Received from Officials of the Museum, Box 15, Folder 7.]

> underfunding], but also on account of the desire of the people of Chicago to retain such objects in their own city as a beginning toward a great civic museum which might serve as a permanent memorial of the World's Columbian Exposition.[6]

Langley also suggested that a good and cooperative relationship existed between the Smithsonian and the fledgling museum in Chicago, which the USNM wanted to succeed. The Smithsonian Institution wanted "to encourage the development of such institutions throughout the United States, and to assist in developing them, and on this account many proffers of specimens were declined, with the recommendation that they be offered to the Chicago Museum, and so far as it was possible to do so, the attention of exhibitors who had collections to dispose of, was directed toward that institution."[7]

The 1893 Chicago Exposition nonetheless revealed that the USNM technology collections had made some progress. As companies, particularly railroad companies, planned their exhibits for the fair, the exhibits at the USNM Transportation and Engineering section in the Arts and Industries Building in Washington served as an important source of information and ideas. "Interest in the department of transportation at the World's Columbian Exposition has led to frequent examinations of the [USNM] collection during the year, the objects both in the exhibition and study series being studied by officials of the Exposition and of several railroad companies who propose to take part therein," Watkins explained. Several persons, who would later be associated with not only technology exhibits at the fair but at the Field Museum, visited Watkins' section. Among them numbered Major Joseph G. Pangborn (1844-1914), who headed the Baltimore and Ohio Railroad Company's exhibit at Chicago and who would later work for the Field Columbian Museum.[8] Pangborn became a major advocate of railway museum displays in the 1890s and 1900s. Willard A. Smith (1849-1923), Chief of the Department of Transportation exhibits at the World's Columbian Exposition, also visited the USNM for several days in August 1891 and reviewed a provisional outline of a proposed exhibit, which Watkins had prepared at Goode's

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[6]"Report of S. P. Langley, Secretary of the Smithsonian Institution, for the Year Ending June 30, 1893," in *Annual Report, Smithsonian Institution, 1894*, 24.

[7]"Report of S. P. Langley, Secretary of the Smithsonian Institution, for the Year Ending June 30, 1893," 24.

[8]Watkins, "Report on the Section of Transportation and Engineering," in *USNM Report, 1892*, 129.

request.[9] Smith wrote to Watkins that the outline of the transportation exhibit "promises to be of much value" and "it will save a great deal of research which would otherwise have been necessary."[10] Thus, while the Smithsonian never sent an exhibit from the transportation and engineering section, that section's exhibits did have an impact on exhibits at the fair. The section itself, back at the USNM, continued its struggle within the Smithsonian.

A Continued Struggle for the Technology Collections at the USNM

In 1894, the USNM changed the name of the Transportation and Engineering section to Technological Collections.[11] The section, however, continued to struggle. The Smithsonian had assigned Watkins, before his leave, to an additional administrative position as head of the library. In his last annual report during his tenure at the USNM, Watkins wrote that his duties as Librarian kept him from accomplishing much for his Section. Moreover, his continuing work for the Pennsylvania Railroad interfered with his museum duties even before he left. Beginning in 1892, the responsibilities of organizing the Pennsylvania Railroad exhibit for the Chicago fair engrossed almost all of his time and attention during the year.[12]

After all of Watkins' struggles, the section began to decline rather than grow. "The floor space assigned to this section in the east hall of the Museum has been reduced in size," he wrote in frustration, and, "as a necessary consequence, the material is now so compactly arranged as to seriously interfere with its value and attractiveness as an exhibit." As noted earlier, even after almost ten years of effort, the section still did not stand on a firm foundation.

Technology exhibits at the fairs, however, continued to grow and develop. In Watkins' view, exhibits had improved dramatically from the 1888 Cincinnati exposition to the time of the

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[9]Watkins, "Report for FY 1892," SIA, RU 158, Annual, Semi-Annual and Monthly Reports of Departments of the USNM, 1881-1897, Box 2, Folder 19. See also, Watkins, "Report on the Section of Transportation and Engineering," in *USNM Report, 1892*, 128-29.

[10]Willard A. Smith to Watkins, August 27, 1891, in *USNM Report, 1892*, 129.

[11]"Staff," *USNM Report, 1894*, 91-92.

[12]Watkins, "Report on the Section of Transportation and Engineering in the U. S. National Museum, 1893," unpublished manuscript, SIA, RU 158, Annual, Semi-Annual and Monthly Report of Departments, 1881-1897, Box 2, Section of Technological Collections, Folder 20.

1893 Chicago exposition. His section had presented its first synoptical display at Cincinnati which had covered a large part of the history of transportation. Watkins believed that his 1888 display served as the "first serious attempt made at an exposition to show the development of this important art separate and apart from all others." He expanded on this work at Paris in 1889, and his 1893 transportation exhibit in Chicago, although not prepared through the USNM, continued the development of distinctive transportation exhibits.[13]

The USNM did not turn out to be the beneficiary of the Chicago exhibit development. At the close of the exhibition at Chicago, the Field Columbian Museum obtained artifacts and models to form, in Watkins' opinion, "the most important transportation collection in the world." The USNM consequently tried to hand over responsibility for exhibits in the area of technology and transportation to the new Field Museum, as Watkins' annual report for 1894 indicated. "The seed sown nearly a decade ago having borne good fruit," Watkins noted, "the function of the section of transportation and engineering of the National Museum will in the future be to present *only the more important relics* relating to the early steps in the history of steam, electrical, and mechanical engineering, leaving the extension of collections showing the development of the art in detail to the department of transportation in the great museum recently founded at Chicago."[14]

The loss of Watkins in 1892 continued a downward trend for the Transportation and Engineering section at the USNM. In his absence, the section sat idle, and no one emerged to take charge of it. Watkins' former clerk, Sallie S. Atkinson, appeared to be in charge of at least tracking the objects in the collection. In 1893, she wrote to William Cox, the Chief Clerk: "In your letter of Sept. 14 you state that I am to look after the accessions in the Sec. of Trans. for the present. Will you not kindly direct that a memo of all changes or removals be sent to me in order that my catalogue can be accurately kept?"[15] In 1894, when Watkins wrote to Goode from Chicago asking for information, Goode referred Watkins to Atkinson by writing that, "under the

[13]Watkins, "Report for FY 1894," SIA, RU 158, Annual, Semi-Annual and Monthly Report of Departments, 1881-1897, Box 2, Section of Technological Collections, Folder 21.

[14]Watkins, "Report for FY 1894." Emphasis added.

[15]S. S. Atkinson to William Cox, October, 20, 1893, SIA, RU 297, Division of Engineering, Correspondence, Box 1, Folder 9, Division of Mechanical Technology, Sept. 14, 1892-Oct. 18, 1899.

circumstances I would suggest that the matter lie over until Miss Atkinson returns, when no doubt arrangement can be made for her to gather together such data as you may desire."[16] During this time period, while Miss Atkinson kept the section records, the section did not continue to develop. With Watkins' absence, the section accomplished little during 1893 and 1894. The number of accessions decreased from previous years.[17] The lack of a consistent hand watching over the technology collections hurt. A later curator for those collections wrote:

> In regard to the collections organized by Mr. J. E. Watkins under the title of Transportation . . . a great deal of confusion has resulted from the fact that these were not continuously in Mr. Watkins' care. . . . During his absence from the city in connection with the World's Columbian Exhibition at Chicago, and subsequently with the Field Columbian Museum, of Chicago, *there was no official in actual active control of the exhibits,* but they were, at various times, looked after by various officials and clerks.[18]

George Brown Goode and Chicago

While George Brown Goode apparently thought that work on exhibits for the Chicago fair would hamper other activities at the USNM, his own work had a major impact on the Chicago fair and those who organized it. In 1891, Goode wrote a "First Draft of a System of Classification for the World's Columbian Exposition."[19] In Goode's opinion, the exhibition would serve as "an illustrated encyclopedia of civilization."[20] Watkins, among others at the Smithsonian, commented on and critiqued the draft. Watkins' comments reflected the interest he shared with Goode in attracting visitors, rather than only performing scientific work with the objects. "Many millions of visitors will see the Exposition, and it is for the visitors' interest especially that the objects on exhibition ought to be arranged," Goode had written.[21] Goode focused his efforts more on

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[16]Goode to Watkins, Field Museum, August 9, 1894, SIA, RU 112, USNM, Asst. Sec. in charge of NM, Outgoing Correspondence, 1879-1907, L94.

[17]"Review of Work in the Scientific Departments, Transportation and Engineering," *USNM Report, 1894,* 76-77.

[18]George C. Maynard, "History of the Division of Technology," SIA, RU 297, Box 7, Division of Engineering, 1886-1956, Records, Folder 2, History of Division of Technology (notes), circa 1906. Emphasis added

[19]Goode, "First Draft of a System of Classification for the World's Columbian Exposition," in *USNM Report, 1891,* 649-735.

[20]Goode, "First Draft of a System of Classification for the World's Columbian Exposition," 654.

[21]Goode, "First Draft of a System of Classification," 649.

visitors than on scientific staff at museums. With this classification, Goode aimed to induce visitors "to come to the Exposition and to look at the exhibits" and, "by means of careful installation and labeling, to make each object teach some useful lesson."[22] Goode wanted to take advantage of the fair's ability to draw mass audiences in order to educate those masses.

Goode divided the exhibits into ten groups: agriculture and allied industries (agriculture, horticulture, forestry, stock-raising, etc.), mines and metallurgy, marine and fisheries, manufactures and other elaborative industries (motors, machinery, transportation, electricity, handicraft, etc.), food and its accessories, the house and its accessories (including costume and personal equipment), the fine arts (pictorial, plastic and decorative), and three sections on the physical, intellectual and moral condition of man–social relations and public welfare; science, religion, education and human achievement; and a collective and monographic series. This division resembled Goode's classification scheme for the National Museum (see Chapter 3). He wanted a "suggestive rather than exhaustive" classification. The overall goals and vision interested him more than the specifics. Nonetheless, the specifics, especially with regard to space for technology, interested Watkins very much. Two areas of the classification provided key openings for technology displays. Group 4, Manufactures and Other Elaborative Industries, proved an important group for mechanical technology collections. In addition, Group 9 had a section, 917, on "applied science," which included mechanical and civil engineering, navigation, and invention.[23]

Some Smithsonian officials specifically urged the inclusion of transportation exhibits in the overall USNM exhibit. R. Edward Earll, Special Agent for the World's Columbian Exposition from the Smithsonian, wrote:

> It would unquestionably be advantageous in the case of certain selected arts and industries to exhibit a large series of specimens showing their development from their primitive beginnings to the most advanced state at the present day. Among the subjects best suited for such treatment would be that of *transportation by both land*

[22]Goode, "First Draft of a System of Classification," 650.

[23]See Goode, "First Draft of a System of Classification," 650-52, also 657-660. Technology and machines were still not a part of the "human achievement" class, including science, religion and education. Also see Goode, "First Draft of a System of Classification," 653, 730.

> *and water.* This subject, which forms so important a part in the history of civilization, should include every mode of transportation known to man, beginning with the most primitive forms of animal transportation, and continuing by means of models, drawings, and pictures to show the various methods of utilizing wind, river, currents, steam and electricity.[24]

While Earll focused on transportation, it remained part of the anthropological or ethnological series.

However, Goode's original plan for the 1893 Smithsonian exhibit, unlike his classification for the overall Exposition, included technology only tangentially. His original outline for the exhibit of the Smithsonian and the National Museum included: the Smithsonian Institution's history and growth; the history of American science and exploration; the natural resources of United States; birds, reptiles and batrachians; vertebrates; zoology; and anthropology. If the exhibit included technology, it would be as a part of the anthropology exhibit that would include the "characteristics of the principal races of men, and the progress of civilization as shown by the evolution of some of the more important arts and industries."[25] In the end, as noted above, the Smithsonian exhibit did not include transportation and technology sections.

Goode's efforts regarding the Chicago Exposition led to an association for him with those persons intent on forming a permanent museum in Chicago, based largely on objects collected for the fair. The Exposition organizers wanted Goode's assistance in setting up such a museum. In November 1893, he responded to a letter from James W. Ellsworth, the head of the Columbian Exposition committee. In response, he outlined the duties that a major museum director should have at such an institution. He also reported that he would be willing to relocate to Chicago, depending on the development of the Field Columbian Museum as a great scientific and cultural center.[26] However, although Goode clearly had an interest in the development of the museum in Chicago, he remained at the USNM for the next three years, until his death.

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[24]R. Edward Earll to Edwin Willits, March 26, 1892, SIA, RU 70, Exposition Records, Box 31, Folder 1, Exposition design and planing, 1890-1892. Emphasis added.

[25]R. Edward Earll to Edwin Willits, March 26, 1892.

[26]Goode to J. W. Ellsworth, November 23, 1893, World's Columbian Exposition, J. W. Ellsworth Correspondence (hereafter cited as WCE/JWE), Incoming, Box 2, Folder 3, Brown-Goode, George, Harold Washington Library Center Special Collections, Chicago Public Library, Chicago, Illinois (hereafter referred to as HWLCSC).

J. Elfreth Watkins and the Chicago Exposition

As noted in Chapter 4, J. Elfreth Watkins left the USNM in 1892 to work on the Pennsylvania Railroad Company exhibit for the Chicago exposition. Later, in Watkins' obituary, Dr. Benjamin stated that "the knowledge which he [Watkins] had acquired with special reference to the early history of the Pennsylvania Railroad led to an invitation which he could not refuse, to return to the service of that corporation, and to organize the exhibits made by them at the World's Columbian Exposition in Chicago."[27] During this time, however, Watkins continued to maintain a connection with the USNM, as well as building new connections to the personnel organizing the new museum in Chicago.

One reason why Watkins went back to work full-time for Pennsylvania Railroad concerned access to resources, money and personnel, which he still had not obtained at the USNM. According to Watkins, Theodore N. Ely, General Superintendent of Motive Power at the Pennsylvania Railroad, intended the company to "expend $75,000 or more . . . for the completion and installation of the company's exhibit at Chicago." In addition, Mr. Ely had "charge of all Machine shops and Model makers on the Pennsylvania Rail Road together with a large and competent corps of draughtsmen" and would put those resources at Watkins' service.[28] But the appeal of the job with Pennsylvania Railroad also involved Watkins' continued desire for the development of transportation exhibits at the USNM and his continued need for recognition in the railway world. In 1892, Watkins wrote:

> I should like, very much, to be permitted to do this work: (1) Because I believe I could make an instructive and valuable exhibit; (2) Because I could mold the character of the exhibit and the size of the Models etc. so that at the close of the World's fair my section in the Museum would acquire a Collection which I see no way of obtaining from any other source; (3) Because this would be considered by the Railway people as a recognition of my 5 years of Museum work; (4) Because it would be a great gratification after 5 years absence from the service of the Company in which I was engaged for 15 years, to be recalled to render assistance of this

[27]Dr. Benjamin, "For the Press [Obituary of Watkins]," SIA, RU 55, Assistant Secretary in Charge of the USNM (Rathbun), 1897-1918, Records, Box 12, General Correspondence, Folder 7, Waldren - Watkins.

[28]Watkins to Goode, August 16, 1892, SIA, RU 31, Box 67, Office of the Secretary (Langley), 1866-1927, General Incoming Correspondence, 1888-1927, Folder 2, Watkins, J. Elfreth, July - October, 1892.

> character at an International Exposition; (5) Because the experience to be gained and the reputation to be made by such a connection at this time would be of great value to me.[29]

While Watkins wanted to continue his association with the USNM, the Pennsylvania Railroad wanted him to work full-time. "I hope it will be possible for you to arrange with the authorities at the Smithsonian to give you a leave of absence of one year, commencing immediately," Ely wrote to Watkins in August 1892. "This Company would like very much indeed to have you get our exhibit together, and take charge of it." The Pennsylvania Railroad wanted Watkins specifically because of what he had tried to accomplish at the Smithsonian. Their exhibit required "someone of experience in collecting historical and analogous data." Watkins' experience at the Smithsonian evidenced the fact that no one else would serve Pennsylvania Railroad as well as he in developing an exhibit for their company at Chicago.[30]

In August 1892, Watkins applied for a one-year leave of absence from the Smithsonian, without pay. He made it clear that, in taking the leave, he might also help the long-range goal of expanding the technology collections at the USNM.[31] According to Watkins, Frederick True, Curator-in-Charge at the USNM, believed that he should retain the same connection to the USNM that he had previous to December 1887, when he had been Chief Clerk of the Amboy Division of Pennsylvania Railroad and honorary curator at the Smithsonian. Watkins felt confident that he could add to the USNM transportation collections while working for Pennsylvania Railroad at Chicago.[32]

In October 1892, Samuel Langley, Smithsonian Secretary, refused Watkins' request for a leave of absence because of the administrative responsibilities at the Smithsonian Library that he had recently taken on. Watkins consequently had to choose between Pennsylvania Railroad and the USNM. However, Langley left an option open for Watkins. "Let me add that should you

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[29]Watkins to Goode, August 16, 1892.

[30]Theodore Ely to Watkins, August 22, 1892, SIA, RU 31, Box 67, Office of the Secretary (Langley), 1866-1927, General Incoming Correspondence, 1888-1927, Folder 2, Watkins, J. Elfreth, July - October, 1892.

[31]Watkins to Langley, August 22, 1892, SIA, RU 31, Box 67, Office of the Secretary (Langley), 1866-1927, General Incoming Correspondence, 1888-1927, Folder 2, July - October, 1892.

[32]Watkins to William C. Winlock, September 8, 1892, SIA, RU 31, Box 67, Office of the Secretary (Langley), 1866-1927, General Incoming Correspondence, 1888-1927, Folder 2, July - October, 1892.

choose the [position] with the Railroad, it will be with my entire goodwill, and that if in that case it would be agreeable to you to retain connection with the Institution as Honorary Curator in the Museum, I shall be pleased to give you that position."[33] In return, Watkins tendered his resignation and expressed his desire to retain the position of Honorary Curator of the Section of Transportation and Engineering at the USNM.[34]

With the resignation, Watkins devoted the major portion of his time to the Pennsylvania Railroad Company exhibit at Chicago. His exhibit focused on the early history of the Pennsylvania Railroad and the merging of its eastern, western and southern lines. He called these lines "pioneer steam roads" which comprised 7980 miles throughout fourteen states.[35] He wanted to include relics, models, drawings and other illustrations, and to set up the exhibit as follows:

I. – The development of the locomotive and rolling stock.
II. – The development of floating equipment.
III. – The development of permanent way, bridges, and signals.
IV. – Canal structures.
V. – Relics for the eastern and western lines.
VI. – Seals and charts illustrating the chronological development of corporate consolidation.
VII. – Miscellaneous views, old and contemporary.
VIII. – Illustrations of typical industries, located along the eastern and western lines.
IX. – Models illustrating statistics of traffic, consumption of stores, etc.
X. – Specimens illustrating the operations of the Dept. of Chemical and Physical Tests.[36]

Watkins, while working on the Pennsylvania Railroad exhibit, took seriously his continued responsibilities as Honorary Curator at USNM. He wrote a report for his Section at the USNM for the 1893 Fiscal Year report, although the Smithsonian did not print it as part of that year's report.[37] Watkins' efforts at the USNM over almost ten years also influenced his work on the Pennsylvania Railroad exhibit. "In preparing this exhibit, the methods of installation and labeling

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[33]Langley to Watkins, October 1, 1892, SIA, RU 31, Box 67, Office of the Secretary (Langley), 1866-1927, General Incoming Correspondence, 1888-1927, Folder 2, July - October, 1892.

[34]Watkins to Langley, October 5, 1892, SIA, RU 31, Box 67, Office of the Secretary (Langley), 1866-1927, General Incoming Correspondence, 1888-1927, Folder 2, July - October, 1892.

[35]Watkins, "Report on the Section of Transportation and Engineering, 1893," unpublished manuscript, in SIA, RU 158, Annual, Semi-Annual and Monthly Reports of Departments of the USNM, 1881-1897, Box 2, Folder 20, p. 6.

[36]Watkins, "Report on the Section of Transportation and Engineering, 1893," 6-7.

[37]See Watkins, "Report on the Section of Transportation and Engineering, 1893," unpublished manuscript, in SIA, RU 158, Annual, Semi-Annual and Monthly Reports of Departments of the USNM, 1881-1897, Box 2, Folder 20.

which prevail in the United States National Museum, were followed in many respects," Watkins wrote in 1893. He also studied a paper, entitled "Museum History and Museums of History," which Goode had presented regarding museum display.[38] However, Watkins' efforts at the Chicago fair aided the Field Museum rather than the USNM due to the reluctance of Smithsonian administration.

Display of Technology at Chicago

By 1893, technology at the world's fairs and international expositions held center stage. Transportation proved to be a key component. "For the first time in the history of world's fairs, it has been decided to give the science of transportation, in its broadest meaning, that attention to which its importance entitles it," declared Chicago Exposition Publicity Department publications. The fair organizers recognized that the technology of transportation, although ever changing, held great importance in the United States infrastructure. They wrote: "The development of modern transportation has been so recent and so rapid that its significance has hardly been understood. Already its early history is in many instances fading away or utterly lost. Judged by their relations to the everyday life of the world, no other industry surpasses it in utility, or equals it as a power in the progress of civilization."[39]

The intended display of transportation technology sought to be all-encompassing as well as a preface to the ultimate accomplishment in transportation–the railroad. The Exposition's Department of Transportation exhibit plan followed a straight chronological pattern. Publications issued by the Department stated:

> The development of water craft from the crudest forms to the modern ocean steamship; of wheeled vehicles, from the first inception of the idea of the wheel to their present seeming perfection; and of that greatest of all means of transportation–the railway–will be illustrated by accurate models, drawings, plans and designs in cases where actual apparatus, appliance or machine itself cannot be exhibited. . . . It is the intent of this department that it shall fully and fairly present the origin, growth and development of the various methods of transportation used

[38]Watkins, "Report on the Section of Transportation and Engineering, 1893," 7.

[39]World's Columbian Exposition, *Classification of the Department of Transportation Exhibits* (Chicago, IL: Donohue & Henneberry, [1892]), 3.

> in all ages and in all parts of the world. As far as possible, the means and appliances of barbarous and semi-civilized tribes will be shown by specimen vehicles, trappings and craft.[40]

As with the rest of the fair, the organizers built transportation exhibits with the hope that they would find a permanent place in a Chicago museum. They claimed to aim for historical accuracy and the preservation of relics, and exposition publicity stated that they hoped the department exhibits would prompt a response from enthusiasts around the world as well as prompt donations of important collections.[41]

The transportation displays at Chicago encompassed enormous spaces. Over fourteen acres existed for railway exhibits; intramural transit (street railways); carriages and other vehicles for Common Roads; bicycles; aerial, pneumatic, et cetera (air); and marine transportation. "The American exhibit will be comprehensive and elaborate to a surprising degree," claimed Willard A. Smith, Chief of the Transportation Department at the Columbian Exposition. The displays covered not only all areas of transportation, but also all areas of the world. "We have an international exhibit of means of transportation of the highest historical interest and the greatest practical importance," wrote Smith. In addition to those from the United States, items from Great Britain, France, Germany, Austria, Spain, Russia, Belgium, the Netherlands, Italy, South America, Mexico, and Canada also graced the exhibit.[42] [See Figure 2 for the Layout of the Transportation Building at the World's Columbian Exposition in 1893.]

The Transportation Building at Chicago signaled a new era for the recognition of transportation's importance in American society.[43] Transportation first received a separate fair building at Chicago in 1893. Moreover, of the main fair buildings, only the Machinery building and the Manufactures building had more square footage and covered more acres than the Transportation Building.[44] The attention paid to the decoration of the exterior and interior of the

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[40]World's Columbian Exposition, *Classification of the Department of Transportation Exhibits*, 3, 4.

[41]World's Columbian Exposition, *Classification of the Department of Transportation Exhibits*, 4.

[42]Willard A. Smith, Chief of Transportation Department, World's Columbian Exposition, to "Gentlemen," September 22, 1892, WCE Departmental Records, Box 3, Department of Transportation, Folder 16, General Information and Correspondence, HWLCSC.

[43]Architect Louis Sullivan (1856-1924) of the Chicago firm of Adler and Sullivan designed the building.

[44]See "General Summary of Area of Grounds," in World's Columbian Exposition, *Report of the President to the Board of Directors of the World's Columbian Exposition* (Chicago, IL: Rand, McNally and Co., 1898), 207.

Transportation Building also revealed the importance of the transportation displays at Chicago. Willard A. Smith considered the subject of the decoration of the Transportation Building an important one, and he believed that it would be "a suitable recognition of the great transportation lines of the world if we could in some way name them in our decoration."[45] The Transportation Building turned out to be quite unique among the main buildings of the fair. The Chicago fair came to be known as "The White City" due to the magnificent classical white structures–including buildings for Administration, Fine Arts, Electricity, Manufactures and Liberal Arts, Machinery, Agriculture, Anthropology, Horticulture and Forestry, Fisheries, and Mines. By contrast, the Transportation Building boasted a colorful exterior, the only one of the main buildings to "violate" the scheme that characterized the fair as the "city of white palaces."[46] The building began at the base with a light, delicate red and proceeded with a polychrome treatment–in thirty different shades–highlighted by a main set of doors with gold leaf, and including a sky-blue statue of locomotive pioneer Stephenson, an emerald green one of steam pioneer Watt, and a terra cotta Edison.[47] [See Figure 3 for a view of the Transportation Building exterior.]

John J. Boyle (1851-1917), a sculptor from Philadelphia, decorated the exterior panels of the Transportation Building. The Exposition's General Superintendent of Buildings described Boyle's work: "In this decoration, Mr. Boyle has been happily successful in carrying out his ideas, viz.: the glorification of the evolution of transportation, a climax beginning with the most primitive mode of travel and ending only with the acme of comfort and speed." Visitors and exposition officials dubbed the eastern door to the structure the "golden door." Contemporary descriptions of the door marveled at its beauty: "This beautiful Romanesque archway, covered with intricate decorative mouldings, flanked and surmounted by bolder reliefs representing

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[45]Willard A. Smith, Chief of Transportation Department, World's Columbian Exposition, to "Gentlemen," September 22, 1892, WCE Departmental Records, Box 3, Department of Transportation, Folder 16, General Information and Correspondence, HWLCSC. Willard Smith suggested trademarks from all the companies and wrote a letter to various companies asking for money to make shields or plaques with their trademarks.

[46]Daniel Hudson Burnham, *The Art of the World: Illustrated in the Paintings, Statuary, and Architecture of the World's Columbian Exposition*, vol. III (New York, NY: Appleton, 1893-1895), xlvii.

[47]Hubert Howe Bancroft, *The Book of the Fair*, Vol. 6 (Chicago, IL: Bancroft Books, 1893), 545. See also Benjamin C. Truman, *History of the World's Fair* (Philadelphia, PA: H. W. Kelley, 1893; reprint, New York, NY: Arno Press, 1976) 340.

primitive and modern methods of travel, and apparently built of the solid metal, will be appreciatively remembered by every visitor to the Exposition."[48] Receding arches ornamented "with allegorical figures, panels and groups in bas-reliefs and with mural paintings" highlighted the door, as well as "the most brilliant of gold and silver bronze."[49] [See Figures 5 and 6 for views of the Golden Door to the Transportation Building.]

Reliefs, statuary and paintings covered the exterior of the building. Two bas-reliefs, flanking the golden doors, juxtaposed the "discomfort of the ancients" and the "comfort we experience in the best modes of travel." Boyle called the design for the tympanum the "Apotheosis of Transportation," including Navigation, Land Transportation, Air, Electricity, and The Sailor.[50] Statuary surrounding the building included several great inventors. The south side of the building boasted pioneers James Watt (steam power), Robert Stephenson (steam locomotives), and Cornelius Vanderbilt (railroad capital).[51]

Boyle's view of transportation differed from Watkins. His "apotheosis" implied the sublimity of transportation. It had achieved almost divine status at its peak. Watkins' transportation remained very earth-based and tied to human work. Both views contained the ideas of progress and evolution at their center. One contemporary observer of the fair exclaimed "How Darwin would gloat over the transportation exhibit!"[52] The exhibit revealed how evolution clearly applied to the "works of man"–transportation systems, for example–even if some still questioned that it applied to man himself.

The effect of the building and Boyle's designs bordered on the religious. The interior of the building, according to one contemporary description, resembled "an ancient basilica."[53]

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[48]William Walton, *Art and Architecture*, Vol. 1 (Philadelphia, PA: G. Barrie, 1893-1895), facing xxx.

[49]Burnham, *The Art of the World*, vol. III, xlvii.

[50]"Report of the General Superintendent of Buildings, January 9, 1894," WCE Departmental Records, Box 3, Department of Works, Folder 36, HWLCSC, pp. 15-16, 17-20. Boyle had begun work as an iron-molder, then a stone-cutter, and eventually a stone-carver. Eventually he attended the Beaux Arts school in Paris and proved to be an award-winning sculptor with an emphasis on the elemental rather than the elegant. Thus, his work matched well with the views of the transportation exhibitors.

[51]Bancroft, *The Book of the Fair*, vol. 6, 545.

[52]Truman, *History of the World's Fair*, 341.

[53]Bancroft, *The Book of the Fair*, vol. 6, 545. See also Truman, *History of the World's Fair*, 340.

Figures of winged angels highlighted the exterior decoration. [See Figure 4 for a detailed view of the angelic figures on the exterior of Transportation Building.] The roles of transportation and mechanical technology in the lifting of physical burdens placed them in exalted positions; steam engines served as a "legion of strong angels."[54] In the Transportation Building at Chicago, America finally recognized their importance. Denton Snider, a contemporary observer, described the reaction to and possible justification for the controversial angels included in the design:

> But those winged figures between the spandrils–what can we make of them? They have perhaps received more censure than any other design at the Fair. Beautiful they can hardly be called, stiff, without perspective, rudely primitive, going back to old Assyria seemingly. The universal objection is that they are mechanical; they have no life, each is like the other, face is without expression; to these depressing qualities wings are added, they are made angels. Yes, such they are, and after a little sympathetic reflection we see that such they ought to be. A mechanical figure with wings, that means flying mechanism–what else is Transportation with its locomotive speeding over the land? . . . It suggests the heavy world of matter taking the pinions of thought and flying, even by way of mechanics.[55]

Beneath each of the angels on the exterior existed panels with names, including Trevithick, Cabot, Cugnot, Jervis, Latrobe, Oliver Evans, Fitch, Bessemer, and others–pioneers in mechanical invention and transportation.[56] Thus, the inventors and builders proved to be the real angels for mankind.

Watkins claimed that historical and material interest in applying generated forces to the development of a great transportation system had grown. That interest, in his view, "made it possible for this, the greatest of expositions, to be held and visited by the thousands, who passing through the 'golden door' of the great Transportation Building exclaim with Bacon – 'There be three things which make a nation great and prosperous, – a fertile soil, busy work-shops, and easy

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[54]Nineteenth-century moralist, Samuel Aiken, wrote in 1851: "God had sent into the world a legion of strong angels to toil for man in a thousand forms of drudgery and to accomplish for man a thousand achievements which human hands could never accomplish." [Samuel C. Aiken, *Moral View of Railroads, A Discourse, delivered on Sabbath Morning, Feb. 23, 1851, on the Occasion of the opening of the Cleveland and Columbus Railroad* (Cleveland, OH: Press of Harris, Fairbanks & Co., 1851), 15.]

[55]Denton Snider, *World's Fair Studies* (Chicago, IL: Sigma, 1895), 156-7.

[56]Bancroft, *The Book of the Fair,* vol. 10, following page 1000. Richard Trevithick (1771-1833) constructed in Britain the first steam locomotive to run on a railroad. Oliver Evans (1755-1819) developed in America an automated flour mill, as well as systems for grinding grain and sifting flour. Henry Bessemer (1813-1898) patented the "Bessemer converter" which converted pig iron to steel using cold air. This process proved essential to developing the important steel for locomotive and railway construction.

conveyance for men and goods from place to place'."[57] This quote from Bacon appeared above the left arm of the arch of the door, while above the right arm the visitor saw the following quote: "Of all inventions, the alphabet alone excepted, those inventions which abridge distance have done most for civilization."[58] The lavishness of the golden door specifically reflected the technological and industrial underpinnings that had built America. "The gate to the colossal fortunes of this country, those of the Goulds and the Vanderbilts, not to speak of lesser examples, has been through Transportation by railway and steamboat," wrote a contemporary observer. "Commerce and manufactures have also been profitable, but have not rivaled Transportation. Hence this Gate is truly typical and belongs just to this Building."[59]

The two main exhibits inside the Transportation Building came from the Baltimore and Ohio Railroad Company and the Pennsylvania Railroad Company, reflecting their importance in the railway world at this time. The Baltimore and Ohio exhibit covered nearly an acre and illustrated railroad development, in engines as well as passenger and freight cars. It included Baltimore and Ohio pieces, but also models of historic engines and locomotives, from Isaac Newton's steam-carriage (circa 1680) and Oliver Evans steam dredge to the most recent locomotives still running on the rail lines. This historical exhibit included thirteen steam engines, thirty-nine full-size reproductions, track specimens, numerous models, and over 1750 pictures. The concept of "progress" pervaded the exhibit, with each successive depiction of an engine or a car as an "improvement." In a separate exhibit area, Baltimore and Ohio presented numerous actual locomotives and full-size reproductions. Then-famous locomotives represented included the *Rocket* and the *Stourbridge Lion,* as well as the *Traveler,* the *Mazeppa,* the *Hercules,* and the *Peppersauce.*[60]

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[57]Watkins, "Report on the Section of Transportation and Engineering, 1893," unpublished manuscript, in SIA, RU 158, Annual, Semi-Annual and Monthly Report of Departments, 1881-1897, Box 2, Folder 20. English philosopher Francis Bacon (1561-1626) dabbled in many areas of science, but primarily developed an influential and lasting philosophy of knowledge that formed the basis of the "scientific method."

[58]Macaulay, quoted in Bancroft, *The Book of the Fair,* vol. 10, following page 1000.

[59]See Denton J. Snider, *World's Fair Studies,* 156.

[60]See Bancroft, *The Book of the Fair,* vol. 6, 547-551.

Pennsylvania Railroad built their own separate pavilion. On it appeared two panels surrounding the main entrance that detailed "four centuries of progress" in transportation from 1492 to 1892. The floating raft, poled against the tide, the rope ferry, the sailboat, the wagon train, the stagecoach, the canal boat, and the steam locomotive juxtaposed with the traveau and canoe of the Native Americans. However, the vast majority of the exhibit focused solely on the advance of that railroad to the South and west and on the technological advances that the company accomplished. The exhibit included models of coal mines, water reservoirs and oil wells to show the consumption of coal, water and oil by the railroad. The Pennsylvania Railroad also exhibited canal technology since the company owned and operated canal systems. The company included its workers and engineers in the exhibit, although not always in a positive light. Figures of trainmen, conductors, brakemen, and other employees appeared in uniform in the exhibit. The exhibits also ranged from models to illustrate wages paid, 1857-1892, to photographs of the railroad riots at Pittsburgh in July 1877.[61] [See Figures 7 and 8 for views of the Pennsylvania Railroad Company Building and Exhibit.]

The period of the 1870s, 80s, and 90s had been one of an uneven relationship between railroad giants, such as Pennsylvania Railroad, and railroad labor, and the inclusion of workers and riots in the 1893 exhibit reflects that relationship. At the Chicago fair, as at many world's fairs, organizers made specific attempts to attract workers to attend. For example, they, in cooperation with factory owners and business managers, sponsored workers' trips, with special or free admissions as well as transportation to the fair grounds. Organizers also had special days set aside for workers to attend when their company did not sponsor special trips. A debate that raged over whether the fair could properly be open on Sundays ended mainly because many workers could only attend on Sundays–their only day off. Thus, what exhibitors presented, and workers saw, held great importance.[62]

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[61]Pennsylvania Railroad, *Catalogue of the Exhibit of the Pennsylvania Railroad Company at the World's Columbian Exposition, under the direction of Theo. N. Ely and J. Elfreth Watkins* (Chicago, IL, 1893), 12, 16, 140-41. See also, Bancroft, vol. 6, 558-560.

[62]For a discussion of the relationship between workers and fair exhibits, see Rydell, *All The World's a Fair* (Chicago, IL: University of Chicago Press, 1984). Rydell argues that several of the world's fairs in the last half of

The Pennsylvania Railroad exhibit became part of the company's efforts to make that relationship smoother. The wages model illustrated that it required a block of silver of the size shown to be coined into silver dollars (412 1/2 grams each) every hour of the day and night to pay wages. For example, for 1857, the block measured 8" x 8" x 9/16" high. By the 1890s, the block size had reached 8" x 8" x 19 25/32" in height. Thus, workers attending the exhibit could visually experience the vast increase in their wages over forty years. Tellingly, a reduction in wage rates most likely led to the 1877 railroad labor strike and riots against the Pennsylvania Railroad. The graphic illustrations of the 1877 riots presented at the 1893 fair included "View of Ruins of Passenger Cars in Union Depot," "View of Interior of Lower Round House, where Troops were besieged," and "View of Locomotive No. 483, destroyed at Upper Round House."[63] The overall visual effect of the illustrations summed up "destruction," naturally by the strikers. Views of the devastating Johnstown Pennsylvania flood of 1889 appeared next to the riot illustrations. Just as Johnstown had been the innocent victim of nature, Pittsburgh and the Pennsylvania Railroad had been innocent victims of discontented workers. A later official history of the Pennsylvania Railroad blamed the discontent of the workers on the national depression of the early 1870s rather than on any specific grievances against Pennsylvania Railroad.[64] The railroad exhibits at Chicago may have presented a historical view of the technical development of the railroad, but they also

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the nineteenth century educated workers in a particular world-view, that is, the view of capital and management. Such a world included wage and labor cuts due to competition, and the united effort and cooperation of workers for the improvement of the whole company (and thus the community in which they lived). In addition, other historians have referred to the Columbian Exposition as an attempt to impose order on the masses. See Alan Trachtenberg, *The Incorporation of America* (New York, NY: Hill and Wang, 1982), Paul S. Boyer, *Urban Masses and Moral Order in America, 1820-1920* (Cambridge, MA: Harvard University Press, 1978), and Robert Muccigrosso, *Celebrating the New World* (Chicago, IL: Ivan R. Dee, 1993), particularly pages 85-87.

[63]Pennsylvania Railroad, *Catalogue of the Exhibit of the Pennsylvania Railroad Company*, 16, 40-41.

[64]For discussions of the 1877 riots, see George H. Burgess and Miles C. Kennedy, *Centennial History of the Pennsylvania Railroad Company, 1846-1946* (Philadelphia, PA: The Pennsylvania Railroad Company, 1949), 365-374; Edward Winslow Martin [James Dabney McCabe], *The History of the Great Riots and of the Molly Maguires* (Philadelphia, PA: National Publishing Company, 1877; reprint, New York, NY: Augustus M. Kelley, 1971), 76-173; Howard W. Schotter, *The Growth and Development of the Pennsylvania Railroad Company* (Philadelphia, PA: Press of Allen, Lane and Scott, 1927), 175-177; 223-226; Patricia T. Davis, *End of the Line, Alexander J. Cassatt and the Pennsylvania Railroad* (New York, NY: Neale Watson Academic Publications, 1978), 45-55; Shelton Stromquist, *A Generation of Boomers: The Pattern of Railroad Labor Conflict in Nineteenth-Century America* (Urbana, IL: University of Illinois Press, 1987); Walter Licht, *Working for the Railroad, the Organization of Work in the Nineteenth-Century* (Princeton, NJ: Princeton University Press, 1983); and Philip S. Foner, *The Great Labor Uprising of 1877* (New York, NY: Monad Press, 1977), 55-78.

presented an historical view of an industry that should not be hampered, or opposed, in its efforts to improve the lives of all Americans.

The exhibits at Chicago resembled what Watkins had wanted while at the USNM, and the railway and transportation industries rather than any museums or cultural institutions provided the main support and artifacts. The companies represented included the Pennsylvania Railroad Company, the Baltimore and Ohio Railroad, the New York Central Railroad, the South Carolina Railway, the Old Colony Railroad, the Illinois Central Railroad, and the London and North Western Railway. "Never in the world's history have so many machines and implements of transportation, land and marine, been assembled, as were to be seen in Jackson Park during the summer of 1893," Watkins insisted. "It is a gratifying sign that many of the great transportation companies that send objects to the World's Fair devote money and space to an historical exhibit."[65]

Technology and transportation, and the personnel associated with them, held prominent places at the World's Columbian Exposition at Chicago in 1893, and, once the fair ended, the technology exhibits were transferred to the new Columbian Museum in Chicago. From the outset, the Exposition organizers intended to transfer the fair to a permanent setting in a Chicago museum. They succeeded in transferring many objects and personnel from the fair, including some from transportation and technology. However, in the long-term, technology and transportation faired less well at the new Field Columbian Museum in Chicago than they had at the USNM. Watkins' mediation proved short-lived, and Joseph G. Pangborn's new cultural brokering proved even less effective.

The Field Museum and its Department of Industrial Arts

In 1894, when the Columbian Museum of Chicago opened, the founders included a new Department of Industrial Arts (DIA). As early as May 1890, an article in the *Chicago Tribune* had suggested that a museum be formed as a result of the 1893 exposition. In 1891, George Brown

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[65]Watkins, "Report on the Section of Transportation and Engineering, 1893," unpublished manuscript, in SIA, RU 158, Box 2, Folder 20, 11. Jackson Park was the site of the 1893 World's Columbian Exposition.

Goode suggested to James. W. Ellsworth, a member of the exposition organizing committee, that the Chicago exposition afforded an opportunity to establish a great museum, and Goode "recommended the immediate appointment of a committee to foster a museum organization." Consequently, a permanent museum existed in the mind of many exposition officials from the beginning of their planning. The officials viewed each purchase for the fair in relation to its future usefulness to such a museum. The Columbian Historical Association formed in 1892 to import exhibits duty-free.[66] The exposition officials also sought public support. George R. Davis, Harlow Higinbotham and James W. Scott, exposition officials, sent out a letter to announce a meeting to discuss establishing a permanent institution.[67] A public meeting followed in August 1893 and adopted "measures to establish in Chicago a great museum that shall be a fitting memorial of the World's Columbian Exposition and a permanent advantage and honor to the city."[68]

In September 1893, the "Columbian Museum of Chicago" applied for a charter, which the state of Illinois granted. The Board of Trustees formed in January 1894. The following May, the museum changed its name to the Field Columbian Museum in honor of Marshall Field (1834-1906), a local merchant who donated a very large sum to put the museum on a firm financial foundation from the start.[69] The Museum's charter stated that the institution should focus on "the accumulation and dissemination of knowledge and the preservation and exhibition of objects illustrating Art, Archaeology, Science, and History."[70] Although reminiscent of the Smithsonian's "increase and diffusion of knowledge," the charter specifically stated the areas of knowledge to

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[66]Oliver C. Farrington, "A Brief History of the Field Museum from 1893 to 1930," *Field Museum News* 1 (January 1930): 1; see also Field Columbian Museum, *An Historical and Descriptive Account of the Field Columbian Museum* (Chicago, IL: Field Columbian Museum, 1894), 10.

[67]George R. Davis, Harlow Higinbotham, and James W. Scott to J. W. Ellsworth, August 14, 1893, WCE/JWE Correspondence, Incoming, Box 4, Folder 8, HWLCSC.

[68]Oliver C. Farrington, "A Brief History of the Field Museum from 1893 to 1930," 3; see also, Field Columbian Museum, *An Historical and Descriptive Account of the Field Columbian Museum,* 11.

[69]Records, Field Columbian Museum, Board of Trustees Minutes, September 30, 1893, and May 21, 1894, Archives and Library, Field Museum of Natural History, Chicago, Illinois (hereafter referred to as FMNHAL).

[70]State of Illinois, "Articles of Incorporation," September 14, 1893, in Field Columbian Museum, *Annual Report of the Director to the Board of Trustees for the Year 1894-1895* (hereafter cited as *Field Museum Annual Report*), 52. See also, Farrington, "A Brief History," 3.

emphasize: art, archaeology, science, and history. Technology still did not have a central place in the new museum.

Nonetheless, when the museum opened on June 2, 1894, Frederick J. V. Skiff (1851-1921), the first Director of the Field Museum and the former Chief of the Department of Mines and Mining at the World's Columbian Exposition, clearly stated that the Museum should "meet the growing needs of a highly developed people, gather up the truths of the sciences and the triumphs of the industries and preserve them as a perpetual benefit to mankind." "We have builded [sic] in a few short months a great structure on the broad highway of progress," Skiff continued. "Science and industry have entered its portals hand in hand."[71] Skiff seemed to place industry and technology on a par with science. However, this idea would not pan out in the long run.

Although the charter explicitly mentioned four areas of knowledge, the museum still needed to determine what those areas meant in practice. In early 1894, the Field trustees decided not to limit the Museum's scope with narrow boundaries. Nonetheless, most of what the Trustees procured focused on the natural sciences. Descriptions of the "main lines of future activities" mentioned curators for anthropology, botany, geology, and ornithology, not industry, technology or transportation.[72] Yet, according to a later history of the museum, the new collections also included artifacts that would naturally fit in divisions of industrial arts, transportation and the railway.[73] A place for technology existed, but not necessarily a planned place.

In May 1894, Skiff made the following recommendations for divisions:[74]

Dept. of Anthropology
Dept. of Geology
Dept. of Zoology
Dept. of Botany
Dept. of Industrial Arts
Subdivisions: Physical Anthropology, Economic Geology, Ornithology, Animal Industry, Textiles, Fish Industry, Ceramics, Transportation
Dept. of the Railway

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[71]Field Columbian Museum, *An Historical and Descriptive Account of the Field Columbian Museum*, 9, 10, 14.

[72]Farrington, "A Brief History" (April 1930): 5.

[73]Farrington, "A Brief History" (March 1930): 3.

[74]Record of the Minutes of the Executive Committee of the Field Columbian Museum, Tuesday, May 22, 1894, FMNHAL.

Columbian Memorial
Exposition Memorial
Library

Skiff, however, had a somewhat troublesome relationship with the museum's founders and subsequent Board of Trustees. The Board, and Field Museum President Edward E. Ayer in particular, held sway, and they focused on conventional museum fields of endeavor. Ayer's personal anthropology collection of North American Indian material, for example, began the Field Museum collections and eventually became the centerpiece of the Ayer Hall of North American Ethnology at the Field Museum. Skiff's push for industrial collections did not carry enough weight. When the museum finalized its operating divisions in 1895, the separate Department of the Railway had been collapsed into the Department of Industrial Arts, and the subdivisions of that department had been reduced to railways and transportation. The traditional museum departments of anthropology, geology, zoology, ornithology, and botany survived the initial discussions and became official operating departments.[75] [See Figure 9 for a floor plan of the Field Columbian Museum, circa 1894.] Like the USNM, the Field Museum established a technology and industry section, but on a very weak foundation. Watkins again began to negotiate a more firm foundation for the representation in this area.

When the Columbian Exposition ended, J. Elfreth Watkins had taken a position as the head of the DIA, including sections on transportation and the railway, at the new Field Columbian Museum. Watkins' experience at the Smithsonian and at the Chicago fair made him the perfect choice for the position. For the next year, he organized the department.[76] According to a Washington, DC, newspaper, "Mr. J. Elfreth Watkins, who has been for a number of years past the curator of the department of transportation at the National Museum, has severed his connection with that institution and leaves Washington either today or tomorrow for Chicago, where he is to take the position of head of one of the great departments of the Columbian Museum, the new institution of the big city by the lake." Little animosity seemed to exist toward Watkins for leaving

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[75]Field Columbian Museum, *An Historical and Descriptive Account of the Field Columbian Museum*, 1.

[76]Dr. Benjamin, "For the Press [Obituary of Watkins]," SIA, RU 55, Assistant Secretary in Charge of the USNM (Rathbun), 1897-1918, Records, Box 12, General Correspondence, Folder 7, Waldren - Watkins.

or towards the new Museum for hiring him. The USNM gave Watkins a banquet that also expressed "the kindly feelings entertained for the Columbian Museum by those who are connected with the Smithsonian here." Speakers at the banquet stressed that "there was no spirit of rivalry between the two, but only the pleasantest wish for hearty co-operation." Watkins stated that the president and the members of the board of trustees of the Columbian Museum wished for "the most cordial relations" between the Chicago and Washington institutions. As noted above, however, Watkins did not completely sever his ties with the Smithsonian. He retained an honorary connection with the Smithsonian.[77] This continued connection would work in his favor when plans in Chicago did not work out as Watkins hoped.

In 1893, Watkins expressed high hopes for the DIA collections at Chicago, on the basis of what companies had collected and built for the exposition. He stated that "the railway collections at the fair which are to remain in Chicago, together with many others illustrating the developments of electrical, mechanical and civil engineering, form the nucleus of one of the three great departments of the museum, the department of industrial arts, that I have been called upon to administer."[78] The DIA collection came primarily from European and American manufacturers, some of which had exhibits at the Chicago exposition. In the opening year of 1894-95, it had the largest total number of accessions, 207, of any department at the museum, and the division of transportation included an additional 56 items.[79] By October 1, 1896, the DIA had registered a total of 13,600 items in the museum catalogue, again more than any other department.

Nonetheless, the DIA as well as Watkins had tentative places within the new museum from the beginning. William H. Holmes, head of the Anthropology Department at the Field–and later the Smithsonian–listed Watkins as the DIA department head in his memoirs.[80] The Director,

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[77]"Watkins Dined, His Associates in the National Museum Say Farewell," *Evening Star* (1893), in SIA, RU 7268, J. Elfreth Watkins Collection, Box 1, Folder 20.

[78]"Watkins Dined," *Evening Star* (1893).

[79]Field Columbian Museum, *Field Museum Annual Report, 1894-1895*, 16, 30. The other departments had the following number of accessions, respectively: Anthropology, 151; Botany, 56; Geology, 177; History, 60; Zoology, 18; Field Museum Annual Report, 1895-1896, 108.

[80]W. H. Holmes, "The Chicago Venture, 1894-5-6-7, Officers and Staff of the Field Columbian Museum," in *Random Records* (manuscript), SIA, RU 7084, William Henry Holmes Papers, Volume VII, p. 16. A misprint exists in the manuscript, and Watkins is listed as L. Elfreth Watkins.

Frederick Skiff, also mentioned Watkins and his accomplishments in DIA. "Mr. Watkins is taking hold in splendid spirit and if his health does not fail, will have a very interesting Department," Skiff wrote early in 1894.[81] However, the official Annual Report of the Field Museum for that year failed to list Watkins as a staff member.[82]

During his tenure at the Field Museum, Watkins borrowed expertise from the USNM. In February 1894, Watkins wrote to George Brown Goode in Washington: "It is probable that [USNM Curator} Mr. Romyn Hitchcock will become associated with the Columbian Museum in an Honorary capacity in a few days. He has expressed his willingness to assist in the installation of the textile collection."[83] In March of that year, Watkins again contacted Goode and asked him to grant two months' leave to E. H. Hawley, a museum preparator, so that he could start work at the Field Museum.[84]

Upon the opening of the museum in June 1894, Watkins suggested the following organization for the Department of Industrial Arts.[85]

I. Division of Printing and Graphic Arts.
II. Division of Engineering:
    A. Mechanical development of the stationery engine.
    B. Marine Engineering. Development of the Steamboat and Steamship.
    C. Electrical Engineering.
        a. Development of the electromagnetic telegraph.
        b. Development of the dynamo for power and light.
        c. Development of appliances for heating and lighting.

Watkins' earlier interest in invention continued at the Field Museum. He told Skiff that "the extension of the collections in the direction of the 'Epoch Making' inventions will increase the

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[81]Frederick J. V. Skiff to Holmes, February 27, 1894, in Holmes, *Random Records* (manuscript), SIA, RU 7084, William Henry Holmes Papers, Volume VII.

[82]"Staff of the Museum," *Field Museum Annual Report, 1894-95,* 6.

[83]Watkins to Goode, February 27, 1894, SIA, RU 189, USNM Assistant Secretary in Charge of the Museum, Box 140, Incoming Correspondence, Folder 3. Romyn Hitchcock had been a curator in the Department of Arts and Industries at the USNM since 1883.

[84]Watkins to Goode (Telegram), March 17, 1894, SIA, RU 189, USNM Assistant Secretary in Charge of the Museum, Box 140, Incoming Correspondence, Folder 3. This is also mentioned in a letter to Director of Field Museum. [See Watkins to Skiff, March 17, 1894, Director's Correspondence, General Correspondence, WA, 1893-1908, FMNHAL.] E. H. Hawley was a Preparator in the Department of Arts and Industries at the USNM beginning in 1883.

[85]Watkins to F. J. V. Skiff, June 12, 1894, Director's Correspondence, General Correspondence, WA, 1893-1908, FMNHAL.

popular interest in the Museum."[86] This extension did not occur, however, and the major portion of the exhibit remained railway pieces. Watkins proved unsuccessful in negotiating a stable place for invention and engineering did not find a place at the Field Museum.

The Field Museum only recorded the first year's accessions for the DIA and its subdivisions of transportation and railway.[87]

Department of Industrial Arts:–	
Donations	183
Loans	8
Purchases	16
Total Accessions . .	207
Division of Transportation:–	
Donations	41
Loans	13
Purchases	2
Total Accessions . .	56
Total Accessions for Museum	725

The DIA exhibits included Textile Industries, Gems and Jewels, Ceramic Industry, Transportation, and the Railway. Watkins arranged these exhibits to "show as far as possible the more important steps which have led to improvement in handiwork, or progress in the invention of those implements, machines, and processes which have proved to be important factors in the world's material development." The Textiles section had two halls that included both specimens of cloth and specimens of machinery to represent the beginnings and development of weaving and spinning. The Ceramic and the Gems and Jewels sections each received one hall for exhibition.[88] These sections occupied about 5% of the total exhibit museum space and were located all in the northwest area of the main building. [See Figure 10 for close-up floor plan of the industrial sections of the Field Columbian Museum in 1894.]

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[86]Watkins to F. J. V. Skiff, June 12, 1894.

[87]*Field Museum Annual Report, 1894-95*, 30.

[88]Field Columbian Museum, *An Historical and Descriptive Account of the Field Columbian Museum*, 77, 77, 79-82. The Textiles exhibit included several looms, including an early Jacquard loom; specimens of flax, hemp, and jute; rugs, tapestries, and fabrics, such as brocades, velvets, damasks, and embroideries. The section on the Ceramic Industry was far from complete at the time of the opening of the Museum. "No effort has been made in the Ceramic Hall to other than care for and arrange with some attractiveness the material that has found its way naturally to the Museum (82)." The Gems and Jewels Section contained gems of every known type, jewels and gems of historical interest, and jewelry.

The transportation and railway exhibits were located separately from the other DIA exhibits and placed in halls in the east pavilion. These exhibits were clearly the largest divisions of the DIA as they required all nineteen halls in that pavilion. The Pennsylvania Railroad Company collection occupied Halls 41 and 57. The overall evolution of the locomotive–an exhibit prepared by Baltimore and Ohio Railroad but including engines from several other railroads–covered Halls 43 through 53 and Hall 56. The evolution of other forms of transportation filled three halls– 40, 54, and 55. Another hall displayed railway appliances and yet another models and statuary.[89] Altogether, the railroad exhibits occupied approximately one-sixth of the museum's exhibit area. [See Figure 11 for close-up floor plan of the transportation sections of the Field Columbian Museum in 1894.]

The major portion of the technology and industry exhibits at the Field Museum came from the Baltimore and Ohio Railroad and the Pennsylvania Railroad exhibits at the Exposition. These exhibits also revealed Watkins' progressive vision of technological development. A museum publication described the division he had created as follows.

> The transportation division of the Field Columbian Museum embracing one of the largest divisions of the Department of Industrial Arts of the Museum, begins with marine navigation. . . . Next in order of transportation are human burthen bearers. . . . Following the human burthen bearers are the pack animals, acquired by gift from the World's Columbian Exposition through the Chief of the Department of Transportation Exhibits. . . . Land vehicles come next in order. . . . Next to the wheeled vehicles is the street car. . . . In order following is the division of the railway which occupies the greater part of the east pavilion, and is one of the most striking features of the Museum.[90]

The Legacy from the 1893 Exposition at the Field Museum

All of the main personnel in DIA came from the World's Columbian Exposition. This borrowing reflected practices throughout the museum. Experts from the exposition staff and

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[89]Field Columbian Museum, *An Historical and Descriptive Account of the Field Columbian Museum,* 87-8. The exhibit included series of models illustrating early methods of transportation in days prior to the railroad, models of early engines and locomotives (including the John Bull), railroad cars, maps, and a collection of original rail sections.

[90]Field Columbian Museum, *An Historical and Descriptive Account of the Field Columbian Museum,* 84-5.

museum professionals from other institutions assisted exhibit organization and installation.[91] Watkins, head of DIA, had been in charge of the Pennsylvania Railroad exhibit at the Exposition. Willard A. Smith, in charge of the Division of Transportation, had been Chief of the Department of Transportation at the Exposition. He had also been an editor in his native Wisconsin, primarily for *Railway Review.* Smith became Honorary Curator at the Field Columbian Museum in September 1894.[92] He later attended the International Railway Congress in Paris in 1900 and in Washington, DC in 1905. Joseph G. Pangborn, in charge of the Division of the Railway, had been in charge of the Baltimore & Ohio Railroad exhibit at the Exposition, as well as Secretary of the American Exhibitors' Association in the transportation area.

While the three areas of industrial arts, transportation, and the railway were closely linked, the three individuals involved in the construction did not necessarily work closely together. All three held similar views regarding technology, its preservation, and its presentation. The concept of "progress" exemplified their history of technology, transportation and invention. Technology played a key role in America, both past and present; thus, lasting memorials to inventions, machines, inventors, and mechanics should exist. Watkins, Smith, and Pangborn all sought to achieve appropriate recognition for technologists. Nonetheless, the three had different methods for achieving their goals. No evidence exists for any substantial conflict between Watkins and Smith. They both worked diligently to build important collections at the Field, and they both viewed modern technology as a progression from older technologies, which previously had formed parts of anthropology and ethnology collections at museums. Moreover, they both left the Field Museum when it became apparent that little room for negotiation existed. Watkins eventually continued his efforts for recognition in the museum world back at the USNM. Smith, by contrast, returned to the world of technologists and world's fairs as the head of the Transportation Department at the 1904 Louisiana Purchase Exposition in St. Louis. Pangborn, in contrast to both

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[91]Farrington, "A Brief History" (March 1930): 3. J. Elfreth Watkins, Willard A. Smith, and J. G. Pangborn are specifically mentioned in the list of exposition staff and experts.

[92]Smith to Skiff, September 29, 1894, Directors' Correspondence, General Correspondence, Skiff, Folder 1, FMNHAL.

Watkins and Smith, proved to be conflictual, arrogant, and overconfident. Pangborn insisted on a separate and distinct focus on the modern railroad system and its development; this insistence left little room for compromise in a museum community where this view clashed with traditional conventions. He also refused to see himself as working under the supervision of Watkins. In 1894, he wrote directly to Skiff regarding the transfer of the Baltimore & Ohio exhibit from the exposition to the Museum. He wondered why he had to go through Watkins to work this out.[93] Such lack of cooperation hurt Watkins' efforts at cultural brokering. Moreover, Watkins' and Pangborn's methods of mediation turned out to be quite different. Watkins continued methods used at the USNM by attempting to work within established museum patterns and structures. Pangborn did not work within established museum practice; rather he alienated the people in power at the Field Museum by his inability to back down and compromise.

Despite conflict between Watkins and Pangborn, the collections gathered at the Chicago fair, and then donated to the Field Museum, constituted the largest railway collection in existence in the United States. Watkins later wrote: "There is no Railway Museum in America. The Field Columbian Museum obtained possession of a number of valuable railway relics exhibited in the Transportation Building. . . . So far as I know, the Field Columbian Museum has the largest collection of this character in America."[94] The extensive group of artifacts and models gathered by the Baltimore and Ohio Railroad for the Chicago Exposition formed the nucleus of the early Field Museum collection. Several other companies also added to the collection, and the transportation exhibit, as a whole, proved unprecedented. Publicity publications for the museum stated that, "at no time previous to the World's Columbian Exposition had there been a fitting illustration of the evolution and development of permanent way, structures, motive power, equipment and appliances of the railroad such as is illustrated in this section."[95] According to Willard Smith, "the great collection of relics, models, photographs, drawings and reproductions, forming the unrivaled

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[93]J. G. Pangborn to Skiff, February 24, 1894, Directors' Correspondence, General Correspondence, Pangborn, Folder 1, January 9, 1894 - April 17, 1894, FMNHAL.

[94]Watkins to R. I. Geare, Chief of Correspondence and Reports, USNM, October 30, 1902, SIA, RU 297, Division of Engineering, Box 2, Records, 1886-1956, Division of Mechanical Technology, October 23, 1899 to . . .

[95]Field Columbian Museum, *An Historical and Descriptive Account of the Field Columbian Museum*, 85.

railway division of the Department of Industrial Arts of the Field Columbian Museum, was collected and prepared by the Baltimore & Ohio Railroad Company, through its agent, Major J. G. Pangborn, and the Pennsylvania Railroad Company, through its agent, Mr. J. Elfreth Watkins."[96] Other railway companies also contributed their exhibits to the Museum. Among them numbered the New York Central and Hudson River Railroad Company, the Chicago and Northwestern Railway Company, and the Illinois Central Railroad Company.[97] Contributions also came from the Mount Washington Railway as well as from Willard Smith.[98]

The Baltimore and Ohio Railroad became the first company to loan its exhibit from the Chicago fair to the Field Museum. In December 1893, the Columbian Museum had approached the railroad about donating the collection. At this time, the Museum also guaranteed the expenditure of $25, 000 over the next two years to extend and complete the collection as J. G. Pangborn had proposed.[99] The following January, C. F. Mayer, President of the Baltimore and Ohio Railroad Company, officially donated the Baltimore and Ohio collection to the Columbian Museum.[100] The registrar's records record it as being received on April 3, 1894 (logged August 28, 1894). However, Baltimore and Ohio withdrew this exhibit in September of 1895.[101]

The Baltimore and Ohio exhibit at the Field included the extensive historical collection that had been built for the world's fair, encompassing the development of steam engines from Isaac Newton, through Nicolas Cugnot, to Richard Trevithick. Thirty-eight full-size, working

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[96]"History of the Collections Presented to the Museum through the Exposition Department of Transportation Exhibits–Willard A. Smith, Chief," in Field Columbian Museum, *An Historical and Descriptive Account of the Field Columbian Museum,* 41.

[97]Field Columbian Museum, *Museum of the World's Rail Way, World's Commission on "Transportation of the World"* (Chicago, IL: Field Columbian Museum, n.d.), 7.

[98]Field Columbian Museum, *An Historical and Descriptive Account of the Field Columbian Museum,* 86.

[99]Telegram, E. E. Ayer, President of Columbian Museum Board of Trustees, to C. F. Mayer, President, Baltimore and Ohio Railroad, December 18, 1893, Railroad Memorabilia Collection, Correspondence 1893-1979, 1893 Folder, FMNHAL.

[100]Mayer to Ayer, January 24, 1894, Railroad Memorabilia Collection, Correspondence 1893-1979, 1894 Folder, FMNHAL. The donation stipulated that the Museum provide the $25, 000 for extension and completion, and that the Museum could not dispose of the exhibit collection without the permission of Baltimore and Ohio. The contract between the Columbian Museum and Baltimore and Ohio Railroad transferred "all rights of possession and ownership in the entire exhibit or collection as stated to the Columbian Museum." [Contract, January 26, 1894, Railroad Memorabilia Collection, Correspondence 1893-1979, 1894 Folder, FMNHAL.]

[101]Accession Records of the Field Columbian Museum, August 1894 to December 1895, Volume 2, No. 5001-10000, FMNHAL. Particular items of interests include 5492-5520 and 5523-5562.

reproductions covered the period from 1680 to 1848, and fifteen original locomotives exemplified developments from 1832 to 1876. The original locomotives came from American improvements. The oldest American-built locomotive in its original form at that time, the *Atlantic* (built in 1832), accompanied three other early engines from the 1830s. The Baltimore and Ohio exhibit also included several of its own original locomotives, such as the first camel back engine–the *Camel*–from 1852.[102]

The second largest part of the Museum's transportation and railway collection came from the Pennsylvania Railroad Company exhibit. This exhibit focused on the progressive growth of the railroad company's system. Pennsylvania Railroad placed the collection into the "care and custody" of the Museum in July 1894, but stipulated that "the full ownership of the exhibit shall remain in the Pennsylvania Railroad Company."[103] The collection included an exhibit series typical of what Watkins had done at the USNM. The exhibit showed the "progress" of transportation from stagecoach and Conestoga wagon, through canal boats, and up to the ultimate achievement of the railway. The famous *John Bull* locomotive appeared in model form, as did several other engines. The bas-relief panels from the Pennsylvania Railroad building at the fair, showing four centuries of progress in transportation, also appeared at the Field. A large collection of rail sections and other railway pieces illustrated the technical development of the railway.[104] Eventually, the Pennsylvania Railroad would take back the care of the collection, and it would leave the Field Museum just as the Baltimore and Ohio collection did.

The World's Columbian Exposition, in addition to its transportation exhibits, included an Agricultural Building, an Electricity Building, a Machinery Hall, a Manufactures and Liberal Arts Building, and a Mines and Mining Building. All of these areas contained some technological and industrial collections. However, few of them ended up at the Field Columbian Museum. The

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[102]See Field Columbian Museum, *An Historical and Descriptive Account of the field Columbian Museum*, 85-7.

[103]"Memorandum of Agreement, made this Third day of July, 1894, between the Pennsylvania Railroad Company and the Field Columbian Museum," Railroad Memorabilia Collection, 1894 Folder, FMNHAL.

[104]See Field Columbian Museum, *An Historical and Descriptive Account of the Field Columbian Museum*, 87-8.

Agricultural Building held a section on "Farming Tools, Implements and Machinery," including mills, grinders, cutters, threshing machines, traction engines, plows, cultivators, harvesters, planters, and more. The Department of Mines and Mining contributed gems and jewels to the Field Columbian Museum. However, the Mining Department at the fair also included machinery such as drills, cutters, furnaces, balances, and other mining machinery that were clearly technological exhibits, but that did not go to the Field. Machinery Hall at the exposition contained boilers, pumps, engines, elevators, cranes, machine tools and fixtures, looms, sewing machines, printing presses, cash registers, and various other machines. Some looms went to the textiles section of the DIA at the Field, but many other machines did not appear at the Museum. The Manufactures Building mainly housed products rather than the machines or technology that produced them. The Field Museum acquired some of these products and displayed them in the Ceramics and Textiles sections of the DIA. The Electricity Building held magnets, coils, converters, batteries, transformers, cable, telegraph instruments, wires, lightening rods, dynamos, incandescent lamps, and various electrical machines.[105] None of these electrical devices entered the Field Museum collections. Thus, a large portion of the technological exhibits at the World's Columbian Exposition had no connection to the Field Museum and its permanent setting.

One long-lasting legacy for the Museum from the Exposition appeared to be the relationship with Joseph G. Pangborn of the Baltimore and Ohio Railroad. Pangborn continually negotiated for the Museum's railway section, arguing persistently that such an exhibit would have practical use. When a discussion of how to (or whether to) elevate the street cars in the Chicago transit system arose in 1894, for example, Pangborn argued that "models, sections and drawings of the great terminal systems abroad" would be "of the highest value" to engineers and other "mechanical experts" charged with designing and constructing the system.[106] Through advocating its practical

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[105]World's Columbian Exposition, Department of Publicity and Promotions, *Condensed Official Catalogue* (Chicago, IL: W. B. Conkey Company, 1893), 14-15, 44-45, 52-56, 77-82, 102-103. Frederick Skiff, first Director of the Field Museum, had been head of the Mines and Mining Department at the World's Columbian Exposition.

[106]Pangborn to Marshall Field, June 12, 1894, Directors' Correspondence, General Correspondence, Pangborn, Folder 3, May 1894, FMNHAL. Pangborn also referred to this practical use of railway collections in other correspondence. "No single question is to-day of such vital import to the City of Chicago as that of the

use and the importance of the railway in everyday American lives, Pangborn negotiated to gain support from outside the Museum that would make the railway division self-sufficient. "No department of the Museum has a clientele to be compared in possibilities of co-operation with the Rail Way," he argued, "and the fact that never before in the World's history has this tremendous interest been cultivated, renders it the greater in possibilities." Pangborn expected that the American Railroad Association "would maintain and keep it up with the times without the expenditure of a penny directly by the Field Columbian Museum."[107]

In accordance with the agreement regarding the donation of the Baltimore and Ohio exhibit, Pangborn set out on a collecting trip. He wrote that, "under the authority and as a representative of the Field Columbian Museum," he planned to visit various countries "for the purpose of securing historical and other materials, originals, models, drawings, photographs, and replicas of divers [sic] character illustrative of the progress and development of the railway in all lands," in order to complete the divisions of Permanent Way, Structure, Motivation, Equipment, Operation, Management and Literature at the "Museum of the World's Rail Way." He wrote further that the Field Museum had decided "to establish, as a component part of the general institution, the Museum of the World's Rail Way, and to so constitute it that in the various divisions the exemplification of evolution and development should be complete."[108]

Pangborn, like Watkins before him, sought help from outside the museum world. However, Pangborn sought help from the cultural, as well as the railroad, elite. He consequently made appeals for support to Andrew Carnegie and Cornelius Vanderbilt, as well as to George M. Pullman (Pullman Car Company), Edward Williams (Baldwin Locomotive Works), Frank

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elevation of the tracks. . . . A series of models with accompanying drawings illustrating the manner in which London overcame difficulties of like character, the railroads and manufacturers being alike served and the city practically rid of surface lines, would at this time be of inestimable value, as would also similar models and data relative to Berlin and other European capitals where the topographical conditions closely resemble those of Chicago." [Pangborn to H. N. Higinbotham May 23, 1894, Directors' Correspondence, General Correspondence, Pangborn, Folder 2 April 18, 1894 - May 25, 1894, FMNHAL.]

[107]Pangborn to Field, June 12, 1894.

[108]*Museum of the World's Rail Way, World's Commission on "Transportation of the World"* (Chicago, Field Columbian Museum, n.d.), 8-9, 13.

Thomson (Pennsylvania Railroad), and Robert Garrett (Baltimore & Ohio Railroad).[109] Also like Watkins before him, Pangborn advanced the idea of the railway system as quintessentially American. In his view, the establishment of a major railway and mechanical museum in the United States seemed only fitting. "There is no railway museum in the world, no mechanical museum, in fact, worthy of the name," he argued. "This country has nearly half of the railway mileage of the world and is unquestionably the first mechanically."[110]

However, Pangborn's ideas for a railway and technological museum clashed with standing museum traditions. Rather than compromise, as Watkins had, Pangborn pushed for a new vision. A technology museum would need "movement" and "popular features." If the Museum was to be "for the education and profit of the masses," then it must be "popularized" and "made spectacular." He argued that he had "some experience on catering to the public, in interesting the masses, and drawing crowds." He suggested providing electrical power to put "in actual action" the locomotives and reproductions, since "each and every one of them was constructed to show operation." Putting everything in motion would be attractive to the curious, but also "of great educational value to the student as well as the expert in mechanisms."[111] Pangborn's ideas reflected more of the display techniques at fairs than of traditional museum methods. In short, he wanted to bring machinery to life and give viewers a real sense of how things worked.

With Pangborn, the ongoing discussion of exhibit techniques came full circle to a school of thought that believed in the dynamics of technology, and, as such, wanted to exhibit it in dynamic settings. Nineteenth-century museums, by contrast, provided static settings. Pangborn specifically argued against "museumistic" presentation methods.[112] His insistence on non-museum methods did not help in his negotiations for a railway museum. Not surprisingly, the museum

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[109]Pangborn to Skiff, April 2, 1894, Director's Correspondence, General Correspondence, Pangborn, Folder 1, January 9, 1894 - April 17, 1894, FMNHAL. Thomson and Garrett had also signed Watkins' petition back in the 1880s.

[110]Pangborn to Marshall Field, June 15, 1903, Railroad Memorabilia Collection, 1903 Folder, FMNHAL.

[111]Pangborn to Field, June 12, 1894, Directors' Correspondence, General Correspondence, Pangborn, Folder 3, May 1894, FMNHAL.

[112]Pangborn to H. N. Higinbotham, May 23, 1894, Directors' Correspondence, General Correspondence, Pangborn, Folder 2 April 18, 1894 - May 25, 1894, FMNHAL.

never implemented his suggestions for power and motion. In fact, by 1896, the Director of the Field Museum denied any connection between Pangborn's Committee on Transportation and the museum.[113]

Pangborn's mediation between the railway and museum communities proved so unsuccessful that, around the turn of the century, Field Museum management decided technology lay outside the purview of the institution. As Harlow Higinbotham, President of the Field Columbian Museum, put the situation in 1902:

> There came a point in the evolution of the internal affairs of the Museum that impressed upon the management the necessity of establishing its limitation. It was determined that the Field Columbian Museum should be a museum of natural history and anthropology. Naturally, Industrial Arts, including invention, thus fell outside the scope of the Museum and gradually within the past two or three years, and since a decision on the actual scope of the Museum was reached, those items, topics and collections not included in the scope thus established have been gradually transferred to such institutions and societies as within which their installation would be appropriate.[114]

By the end of 1904, J. G. Pangborn pushed to have the Baltimore and Ohio railway collection permanently transferred elsewhere because the Field Museum under-utilized and under-displayed it. "A railway collection has no place in a great institution devoted to Natural History," he maintained. "It's a case of two masters. The one served would be natural history. The other would continue in the future, *as for the eleven years past, merely tolerated.*"[115]

Rather than deaccessioning its technology and transportation collection quickly, the Field Columbian Museum disposed of it over time. In 1907, the museum returned a bicycle collection to the Pope Manufacturing Company of Hartford, Connecticut. Also in 1907, the Museum made arrangements to return the large exhibit collection that belonged to the Pennsylvania Railroad Company. In 1908, correspondence with the Baltimore and Ohio Railroad Company reiterated that

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[113]Skiff to J. L. Carter, Chicago, Burlington & Quincy Railroad Co., April 7, 1896, Directors' Correspondence, General Correspondence, Pangborn, Folder 5, April 4, 1896 - March 12, 1906, FMNHAL.

[114]H. N. Higinbotham, President, Field Columbian Museum, to W. E. Stone, Chicago, December 22, 1902, Railroad Memorabilia Collection, Correspondence 1893-1979, 1902 Folder. The collection was offered to Purdue University and the University of Chicago, among other institutions. The eventual resting place of this collection is undetermined, even by the current Field Museum staff. Many of the models, however, do resemble ones currently at the Baltimore and Ohio museum in Baltimore, Maryland.

[115]Pangborn to Higinbotham, October 6, 1904, Railroad Memorabilia Collection, 1904–2 Folder, FMNHAL. Emphasis added.

the railroad company retained total control over that collection. By then, the collection was in storage in the Baltimore and Ohio shops in Martinsburg, West Virginia, not on display at the Museum in Chicago.[116]

No apparent legacy of appreciation for technology followed permanently from the exposition world to the museum world in Chicago. Pangborn expressed his disgust in a letter to the Field Museum director in June 1894:

> The tendency in interest in Museums has ever been toward such as may have preceded in other Museums. Advocates of departmental divisions which have long been established are numerous, earnest, and as a rule, of single ideas, and probably in no other field of effort is it so difficult to introduce an innovation as in the Museumistic. . . . Little or no genuine interest has been manifested among those constituting the Committee, and now that I have completely filled a dozen rooms, the mere fact of having covered such extent of space appears to be regarded as of greater importance than the value or future of the nucleus so placed.[117]

Pangborn specifically warned that, if the Field Museum did not show greater interest in the expansion of the section, "interest in it by Railroad and kindred companies, as well as those who control them, will [be] transferred, . . . and all chance of securing the support of the American Railroad Association will be gone, and with it the co-operation which now has but to be asked to render the future certain." Evidence of the interest of railway personnel appeared in requests for information. Pangborn reported, for example, "the President of the Master Car Builders Association has written me for a statement of the Museum plans to incorporate in his annual report, and similar information has been requested for the Association of General Superintendents of Motive Power."[118] For Pangborn, the Museum had to seize the opportunity or the interest would die out. The Field Museum chose not to seize.

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[116]See Records, Field Columbian Museum, Board of Trustees Minutes, January 28, 1907, May 28, 1907, July 8, 1907, and June 8, 1908, FMNHAL.

[117]Pangborn to Skiff, June 4, 1894, Directors' Correspondence, General Correspondence, Pangborn, Folder 3, FMNHAL.

[118]Pangborn to Skiff, June 4, 1894, FMNHAL.

The Departure of Watkins and the Decline of Technology at the Field Museum

The personnel and collections that made up the technological and industrial areas of the Field Museum began to fade quickly. When the first Field Museum first annual report appeared in 1894, Watkins name was not listed under "Staff."[119] Although the Museum elected Willard A. Smith Honorary Curator of the Department of Transportation in 1894, J. Elfreth Watkins resigned shortly thereafter. By 1896, the museum's annual report no longer listed J. G. Pangborn as Curator either. The DIA continued to receive the assistance of John C. Simms as Assistant Curator in December of 1895, but the department itself had little time left. By 1897, its name had disappeared from the museum's annual report.[120]

The reasons for Watkins' departure from Chicago and return to the USNM do not appear completely clear. Hints of problems at Chicago appear from the beginning and probably had a bearing on Watkins' decision to leave. William Holmes, who headed the Anthropology Department at Chicago and also left for a position at the USNM, wrote:

> The scientific staff of the Museum was gradually getting into a state of rebellion against Director Skiff as a result of his unappreciative and tyrannical attitude, but the attempt to dislodge him was frustrated by Mr. Higinbotham, who, knowing nothing regarding the claims of the scientific staff on the consideration of the management, stood by his protégé. For my own part, seeing the hopelessness of conditions in the Museum I began to turn my face again towards Washington.[121]

In Holmes' view, the problems resulted from the decision to have non-museum personnel run the museum. "From the day of my arrival here, three years ago, there has been cause for discontent," he wrote. He continued:

> The trouble developed out of the Chicago idea that only a business man, and a business man only, can conduct the business of an institution – museum or otherwise – which would have been well enough had the man chosen as director

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[119]"Staff," *Field Museum Annual Report, 1894-95*, 6.

[120]See Record of the Minutes of the Executive Committee of the Field Columbian Museum, Wednesday, September 19, 1894, and Tuesday, October 2, 1894, FMNHAL. See also, *Field Museum Annual Report, 1895-96*, 86, and Record of the Minutes of the Executive Committee of the Field Columbian Museum, Monday, December 2, 1895, FMNHAL. In 1912, Simms took charge of the N. W. Harris Public School Extension of the Field Museum, and he eventually became Director of the Museum. For listing of museum departments in 1897, see *Field Museum Annual Report, 1896-97*, 172.

[121]W. H. Holmes, "Section III: Resignation of curatorship in the Field Columbian Museum and return to Washington as Head Curator of Anthropology, National Museum, 1897," in *Random Records* (manuscript), SIA, RU 7084, William Henry Holmes Papers, Volume VII, Section III.

> been qualified for the work. The director appointed did well enough in getting together and installing the vast exhibits brought together at the close of the World's Fair, but when we came to settle down to scientific methods and work there was a total lack of appreciation and sympathy and we were hedged about with difficulties and embarrassments about which the outside world can have little conception.[122]

Nonetheless, one would think that the things that Holmes disliked in Skiff should have helped Watkins and the DIA. Skiff had come from outside the museum world and had made DIA separate from Anthropology. Unlike other museum administrators of the time, Skiff had given technology and industry a prominence of their own. Holmes admitted as much when he wrote a friend that "when I arrived in Chicago, contrary to promises made, I found the *Department of Anthropology of which I was to take charge divided into Anthropology and industrial arts, with no well-defined line between them,* and I gradually learned that the latter, being favored by the director because of the name 'Industrial' was to be built up at the expense of the former." Eventually, the Museum rectified some of the problems that Holmes had with Skiff, but the resulting changes hurt DIA and the technology collections. "The business director has been deprived of his absolute power over the scientific departments, and numerous attendant changes have been made," Holmes recounted. "In my own field, for example, *the two objectionable departments have been abolished and the exhibits nearly all thrown back to Anthropology where they belong.*"[123] This same year, 1897, Holmes left the Field Museum to take a job at the USNM and assisted in abolishing its separate Department of Arts and Industries by transferring control over the technology collections to the head of Anthropology.

In 1897, Field Museum Director Skiff recommended to the Executive Committee of the Museum "a re-organization of certain Departments of the Museum." The intended purpose included "simplifying and unifying the method by which the aims and scope of the Institution may be accomplished in the most direct and economic manner." Skiff intimated that he had made his recommendations due to pressure from the Board of Trustees, since the recommendations appeared

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[122]Draft letter, Holmes to Charles D. Walcott, January 28, 1897, in *Random Records* (manuscript), SIA, RU 7084, William Henry Holmes Papers, Volume VII.

[123]Draft letter, Holmes to Walcott, January 28, 1897, in *Random Records* (manuscript), SIA, RU 7084, William Henry Holmes Papers, Volume VII. Emphasis added.

"in accordance with interviews with you touching the re-organization of certain Departments of the Museum." Specifically, Skiff recommended that:

> The Department of Industrial Arts be abolished and a division created in the Department of Anthropology to be called the Division of the Arts and Industries. . .
> That the title of S. C. Simms be changed from Assistant Curator of Industrial Arts to Preparator in the Department of Anthropology, his duties to be defined by the Curator of that latter Department.
> That there be created the Department of Transportation to which shall be conveyed of record such material as would naturally be accessioned in such Department, embracing all methods, devices and inventions or models thereof for the conveyance by land or water of peoples, freight, goods, chattels, etc. not only ancient but modern and including specially all the material now installed in Halls 37 to 58 inclusive, and such isolated, stray or unclassified exhibits as may not be properly classified in Anthropology as Electrical appliances, Historical material, agricultural implements, and models, etc.
> That this Department be in charge of the Director of the Museum with Willard A. Smith as Honorary Curator.[124]

The Executive Committee ordered the Director "to carry out the said recommendations and to make the re-appointments, re-organizations and alterations operative at once."[125] Although the transportation collection continued to exist, it became subordinate to Anthropology and eventually disappeared from the institutional organizational charts altogether.

As noted above, during the opening year of the Field Museum in 1894-95, the DIA had the largest total number of accessions of any department at the museum. By October 1, 1896, it had registered a total of 13,600 items in the museum catalogue; again, this proved more than any other department. Yet by 1897, the Museum abolished the DIA.[126] The Field Museum technology collections collapsed into the Anthropology Department and disappeared. Although Watkins and Pangborn had made great efforts to broker a place for a permanent technological collection in Chicago, they failed. While Watkins had attempted mediation and compromise, J. G. Pangborn had often used confrontation and conflict and refused to work within normal museum practices. Eventually, Pangborn rejoined his colleagues at the Baltimore and Ohio Railroad Company and Watkins returned to the USNM. The traditional areas of museum expertise and concern–such as

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[124]Record of the Minutes of the Executive Committee of the Field Columbian Museum, Monday, January 18, 1897, FMNHAL.

[125]Record of the Minutes of the Executive Committee of the Field Columbian Museum, Monday, January 18, 1897, FMNHAL, 106-107.

[126]*Field Museum Annual Report, 1894-95,* 16, 30; *Field Museum Annual Report, 1896-1897,* 173.

ethnology and anthropology–once again prevailed over the new areas of technology, transportation, and industry.

FIGURE 1.

Ground Plan of the United States Government Building
at the World's Columbian Exposition, 1893.
[From World's Columbian Exposition, *Condensed Official Catalogue*, 1893.]

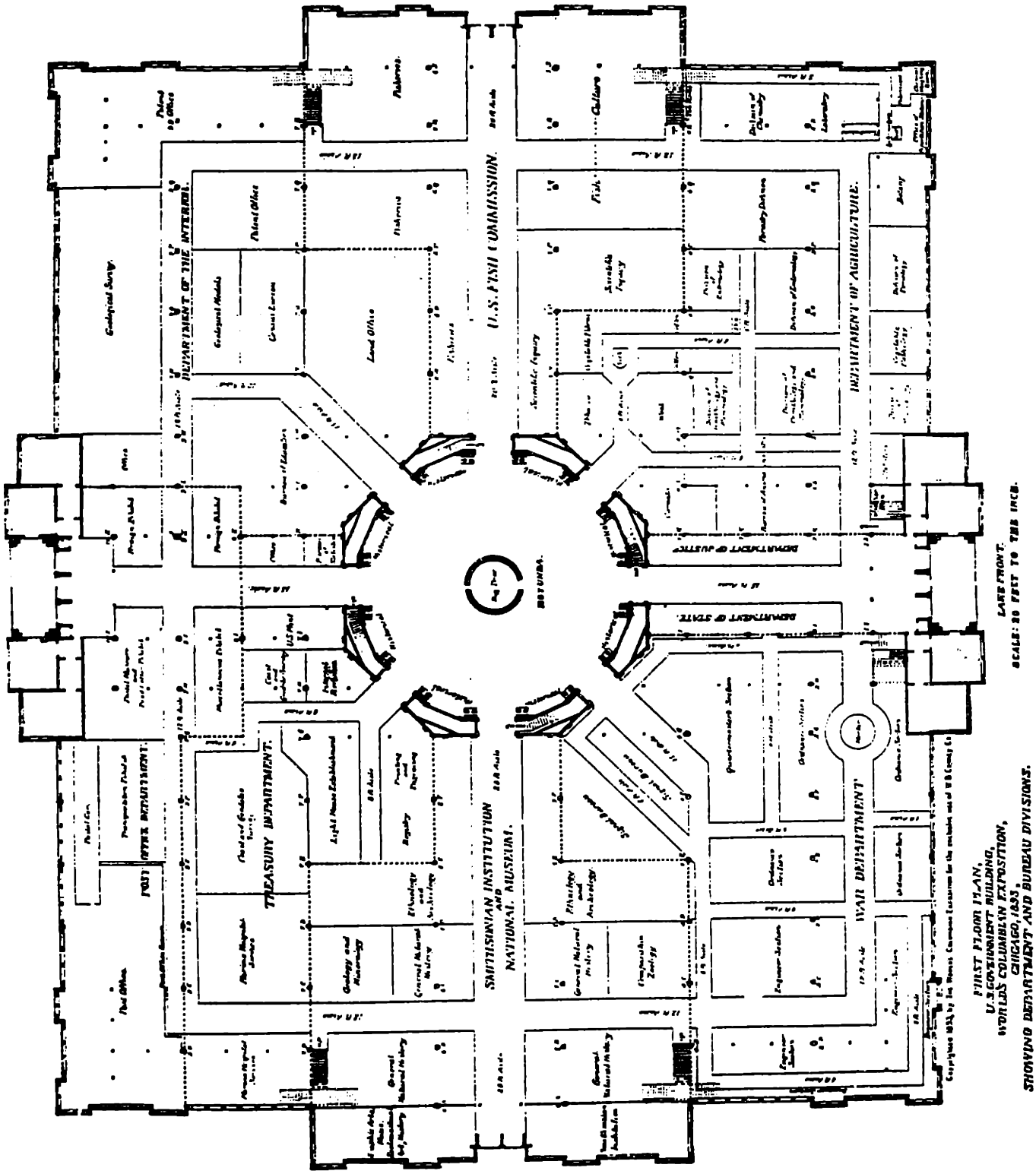


FIGURE 2.

Layout of the Transportation Building at the World's Columbian Exposition in 1893.
[From World's Columbian Exposition, *Condensed Official Catalogue*, 1893.]

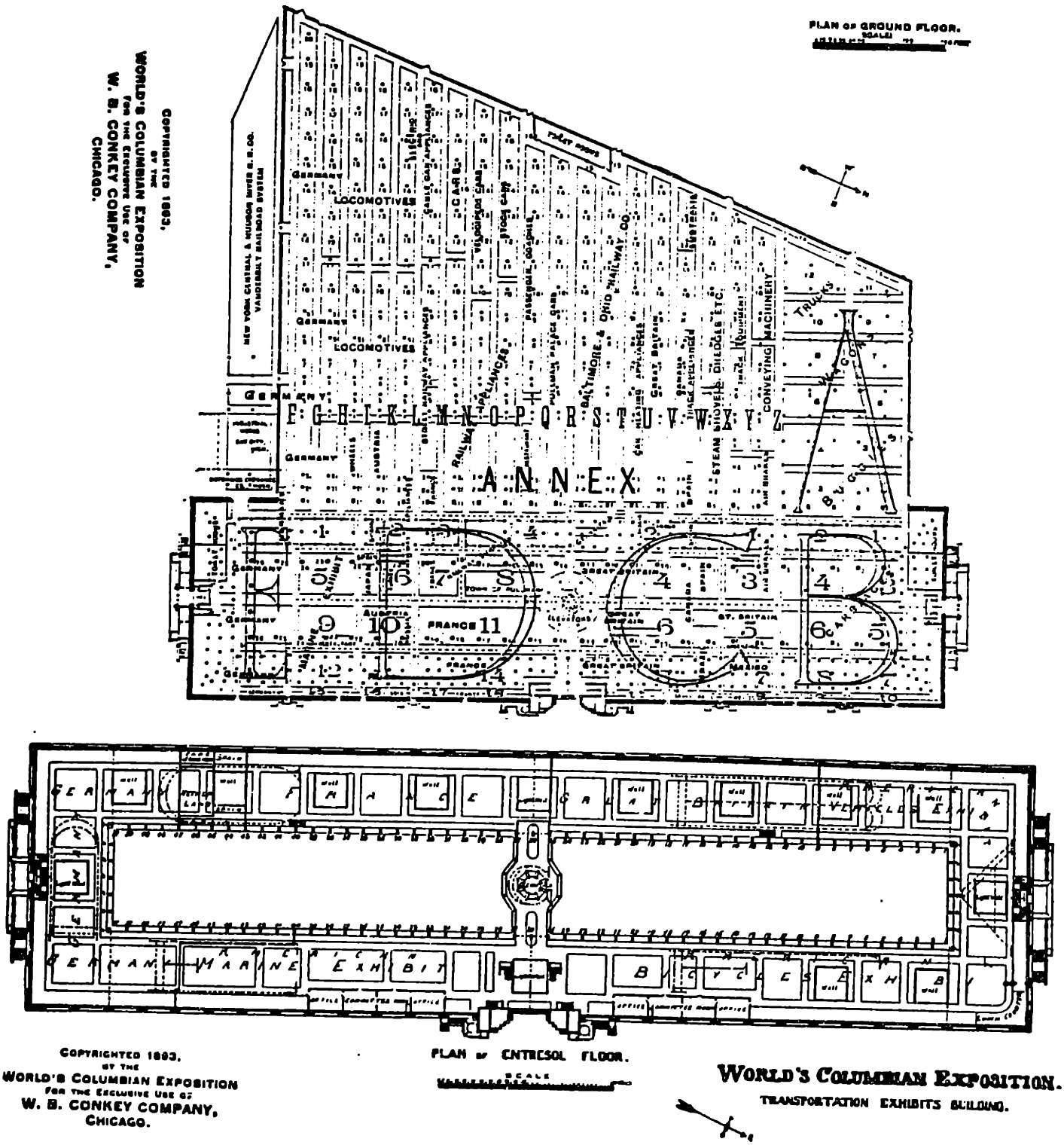


FIGURE 3.

Exterior of the Transportation Building at the World's Columbian Exposition.
[From *Classification of the World's Columbian Exposition,* 1893.]

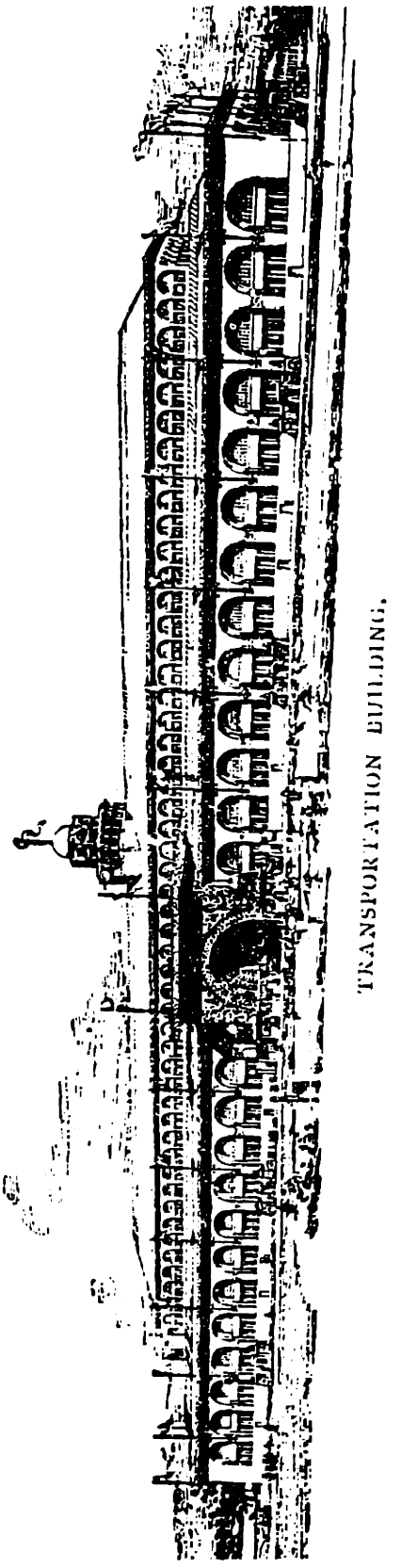


FIGURE 4.

Exterior of the Transportation Building at the World's Columbian Exposition, with winged, angelic figures.
[From Hubert Howe Bancroft, *The Book of the Fair*, v. 6, 1893.]

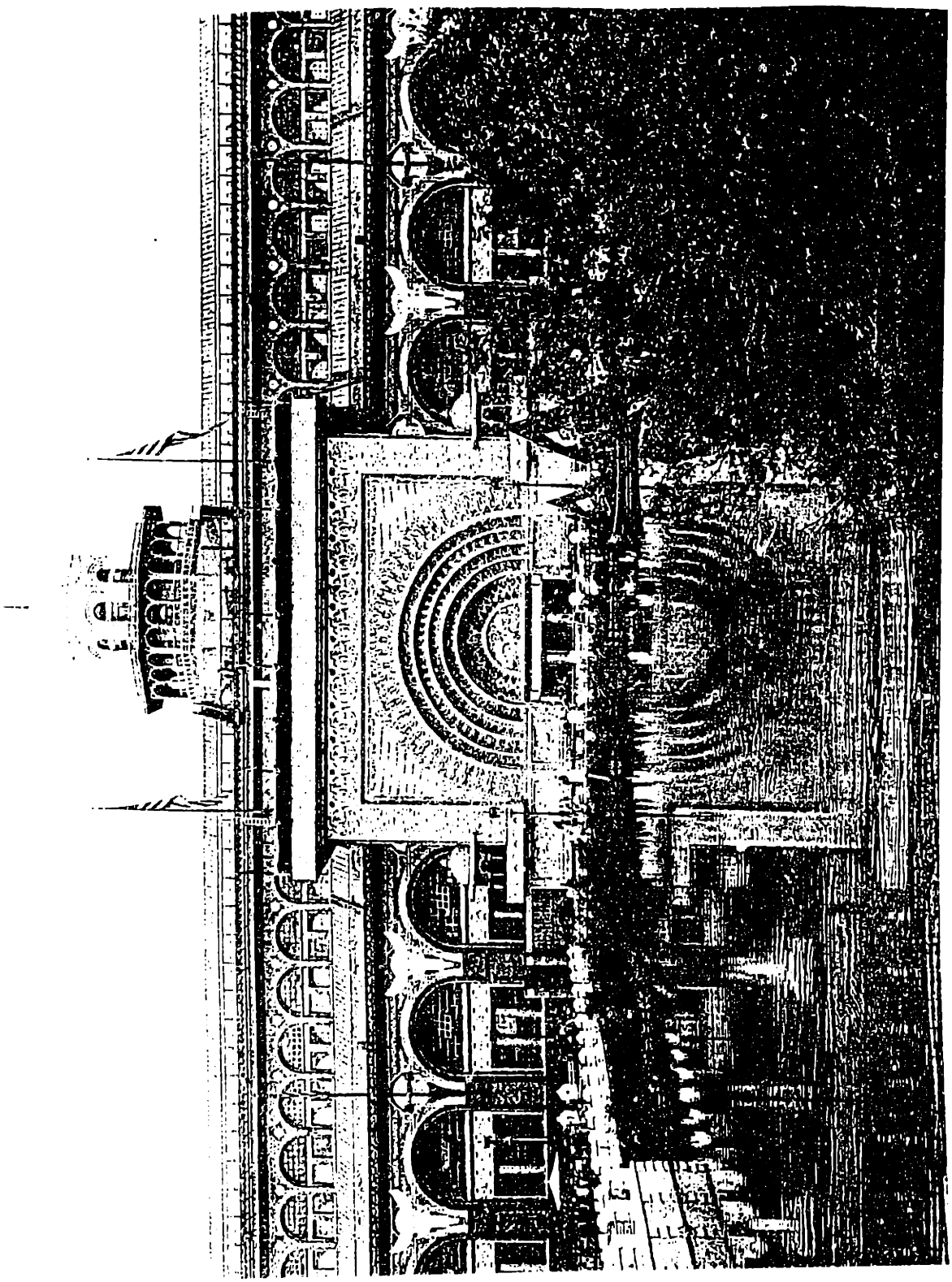


FIGURE 5.

Golden Door, Transportation Building, World's Columbian Exposition.
[From Rand, McNally & Co.'s *Handbook of the World's Columbian Exposition*, 1893.]

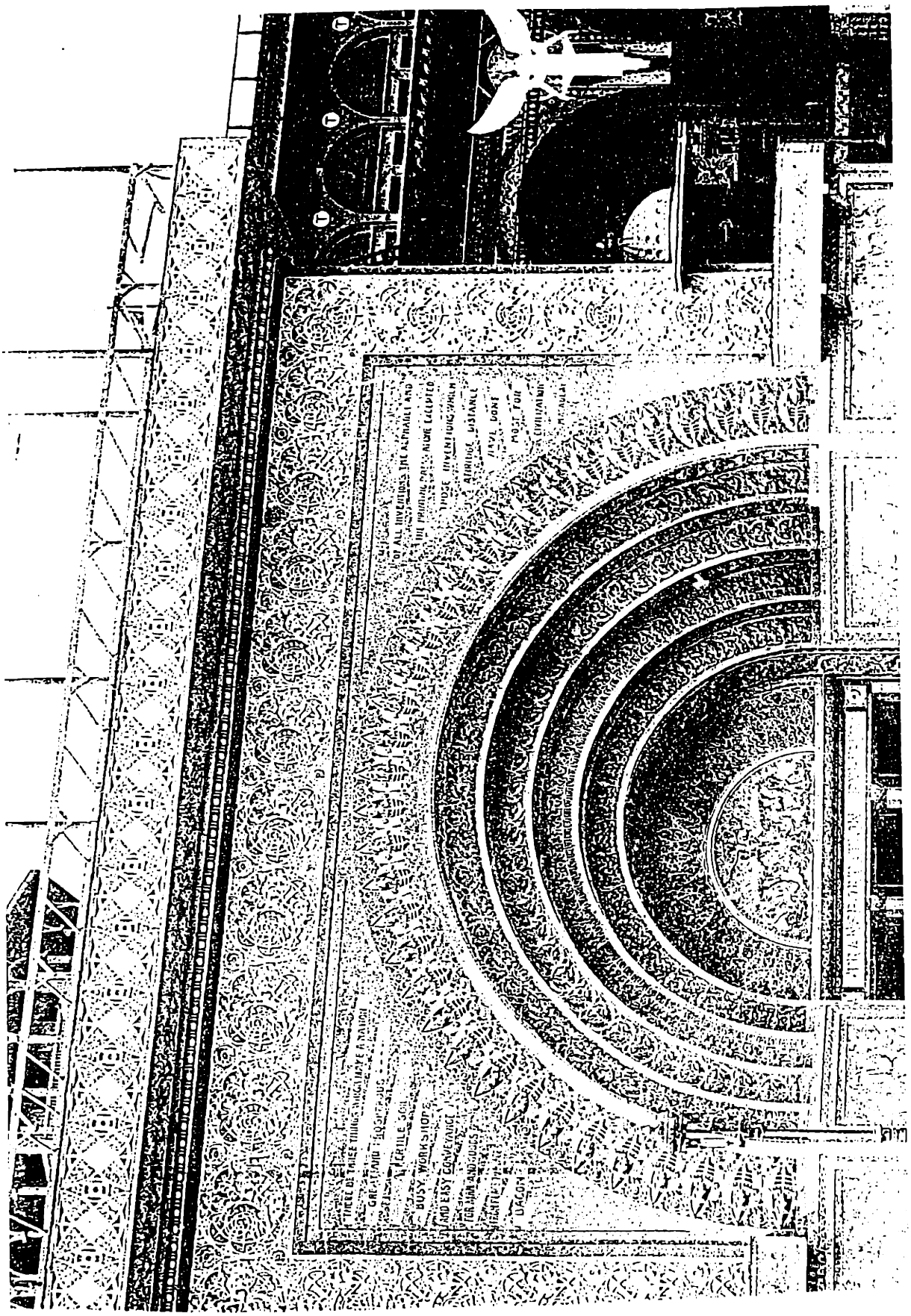


FIGURE 6.

Detail of Main Doorway of the Transportation Building, World's Columbian Exposition. [From Hubert Howe Bancroft, *The Book of the Fair*, v. 6, 1893.]

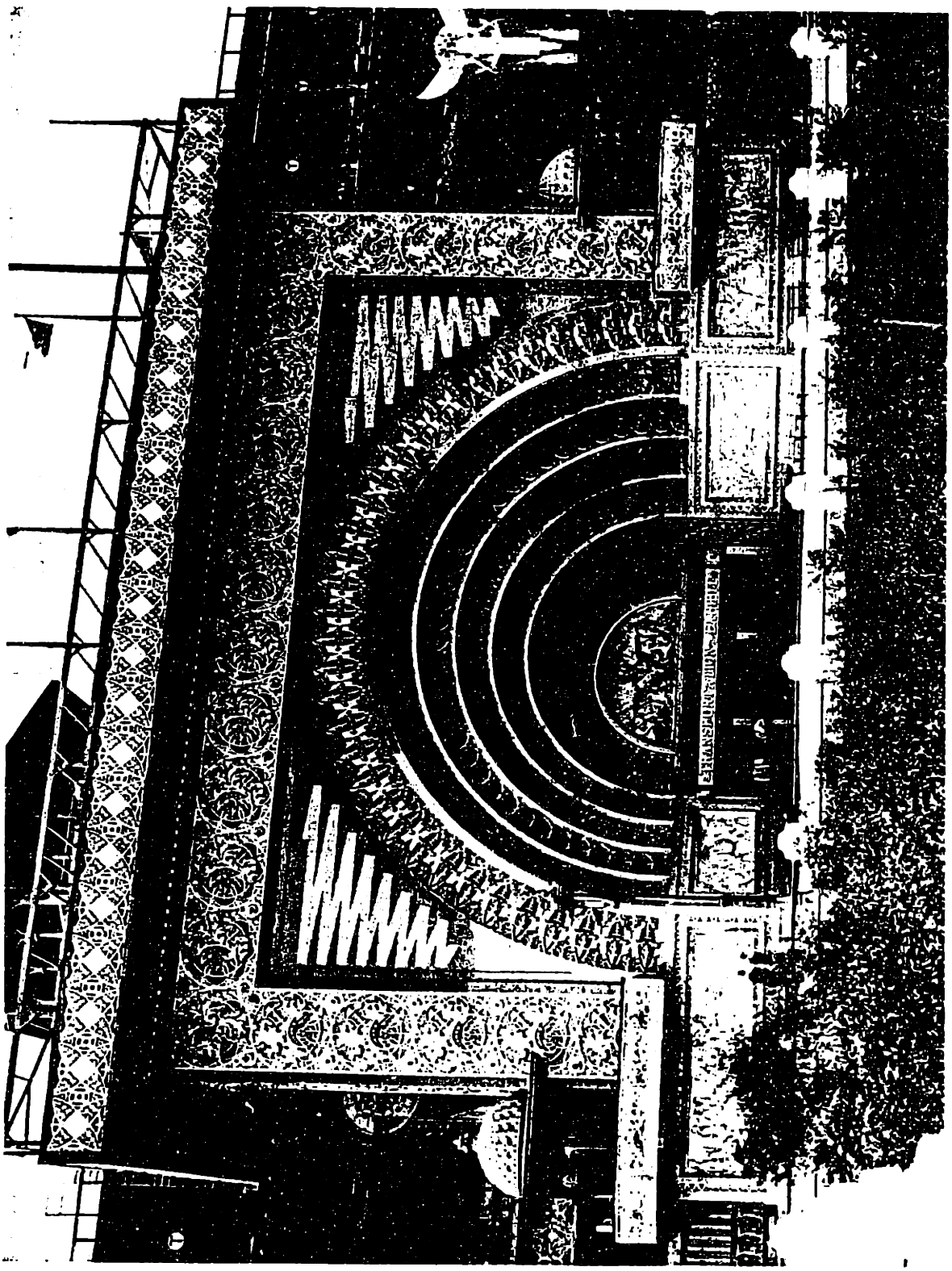
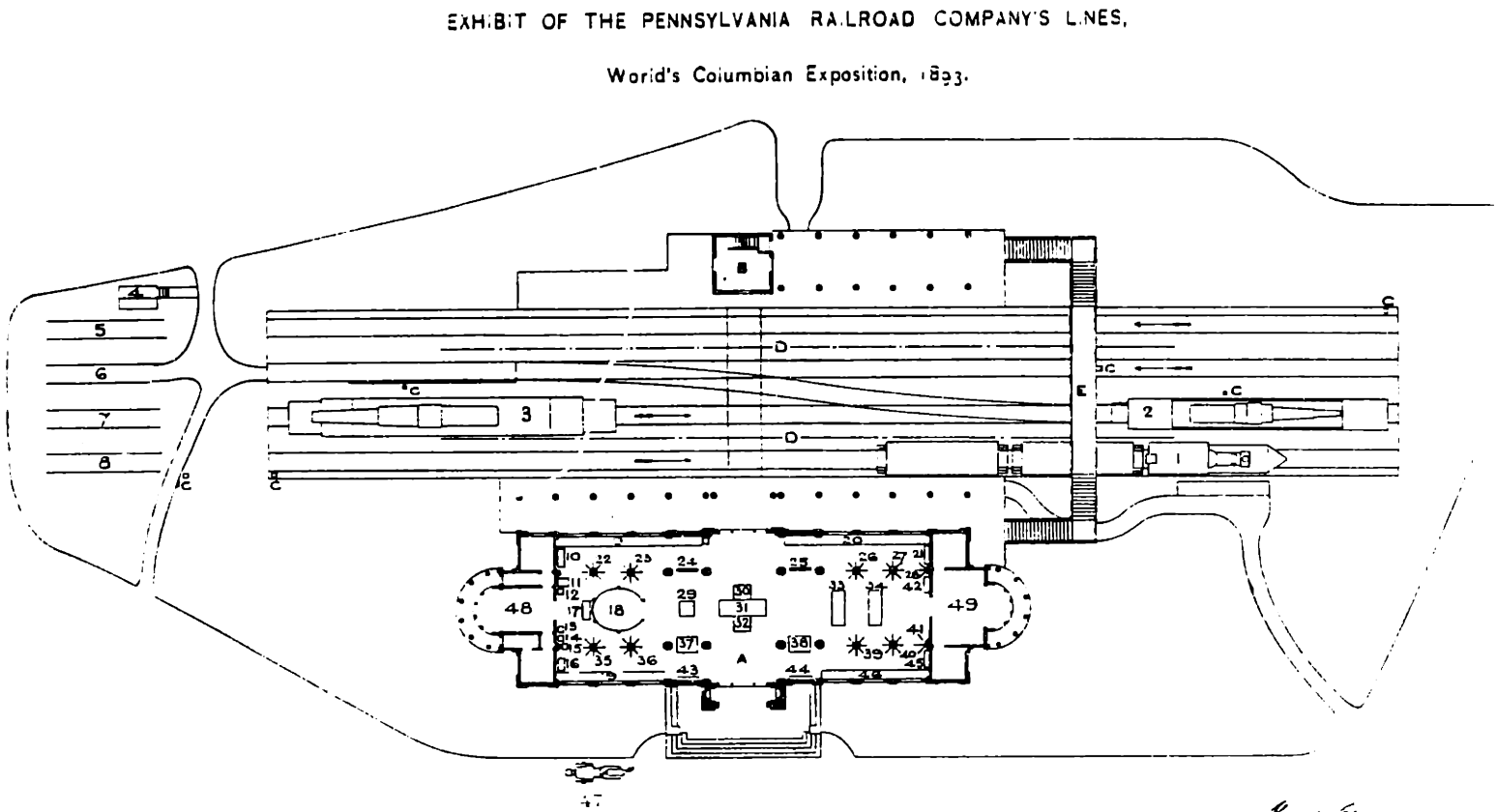


FIGURE 7.

Pennsylvania Railroad Company Building and Exhibit, World's Columbian Exposition. Exterior of Building.

[From *Catalogue of the Exhibit of the Pennsylvania Railroad Company at the World's Columbian Exposition,* 1893.]

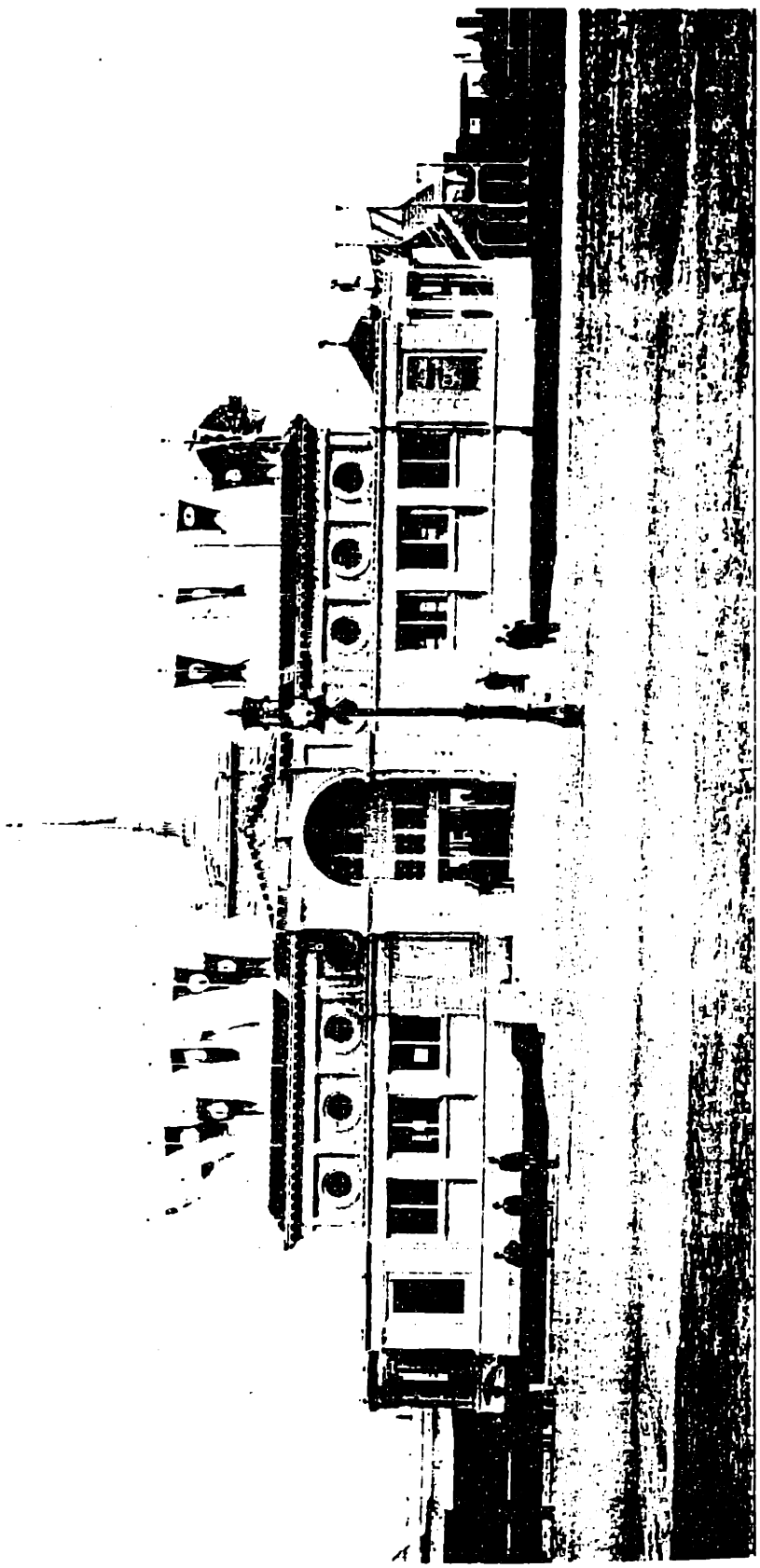


A Main Exhibit Building.
B Signal Tower — Pneumatic Interlocking Switches.
C C Signals.
D D Iron Fences.
E Foot Bridge over Tracks.
1 "John Bull" Train.
2 Gun Truck, weight 115,300 lbs.
3 Gun Truck, weight 175,400 lbs.
4 Old Saxby and Farmer Interlocking Switch.
5 Old Portage R. R. Truck.
6 Old Madison and Indianapolis R. R. Track.
7 Old Camden and Amboy R. R. Track.
8 Old Tracks, Rails, Frogs, Switches, &c.
9 Relic Case.
10 Relics.
11 Lay Figure, Porter.
12 Lay Figure, Baggage Master.
13 Lay Figure, Brakeman.
14 Lay Figure, Conductor.
15 Lay Figure, Pilot.
16 Old Car Seat.
17 Relics.
18 Chart of P. R. R. System showing location of Trains at 6 o'clock P. M., October 21, 1892.
19 Case of Statistical Models and Products of Altoona Shops.
20 Case of Models of Old Rolling Stock Equipment.
21 Models of J. M. and I. Engine and Cars.
22 Old Passes, Letters, Time Tables, Contracts, &c.
23 Old Posters, Passes, Time Tables, &c.
24 Chart showing organization of the P. R. R. Co.
25 Seals of corporations merged into or united in interest with the P. R. R. Co.
26 Photographs of Locomotives constructed by or for the P. R. R. Co.
27 Photographs showing R. R. property destroyed by the Johnstown flood.
28 Photographs showing typical industries located on P. R. R. System.
29 Globe illustrating Traffic on P.R.R. System.
30 Relief Map, Plane No. 1, Old Portage R. R.
31 Relief Map, Territory between Altoona and Johnstown.
32 Relief Map, Horseshoe Curve.
33 Model of Ferry Boat "Washington."
34 Model of Tug Boat and Float with Freight Cars, N. Y. Harbor.
35 Maps, Old Tickets, Notices, &c.
36 Views relating to the Stage Coach and Canal Boat Era, Tickets, Memoirs, &c.
37 Model of Philadelphia Terminal.
38 Model of New York Terminus.
39 Views of Bridges, Tunnels, Stations, &c.
40 Views of Typical Industries located on Eastern and Western Systems.
41 Views of Bridges, Tunnels, Stations, &c.
42 Models of Coal Cars.
43 and 44. Tablets in relief—Four Centuries of Progress in Transportation. I. 1492-1592.—II. 1792-1892.
45 Model of Tunnel under Tracks.
46 Engineering Models, Switches and Frogs, &c.
47 Standard Hansom Cab.
48 Office of Special Agent.
49 Bureau of Information, Passenger Department.

Geo. W. Ely
Chief of Motive P.
J. E. Watkins
Special Agent
in charge of Exhi.

FIGURE 8.

Pennsylvania Railroad Company Exhibit, World's Columbian Exposition.
[From *Catalogue of the Exhibit of the Pennsylvania Railroad Company at the World's Columbian Exposition*, 1893.]



PENNSYLVANIA RAILROAD BUILDING,

World's Columbian Exposition. Located near 64th Street entrance, Jackson Park.

(NORTH FRONT.)

FIGURE 9.

Floor Plan of the Field Columbian Museum, circa 1894.
[From Field Columbian Museum, *An Historical and Descriptive Account,* 1894.]

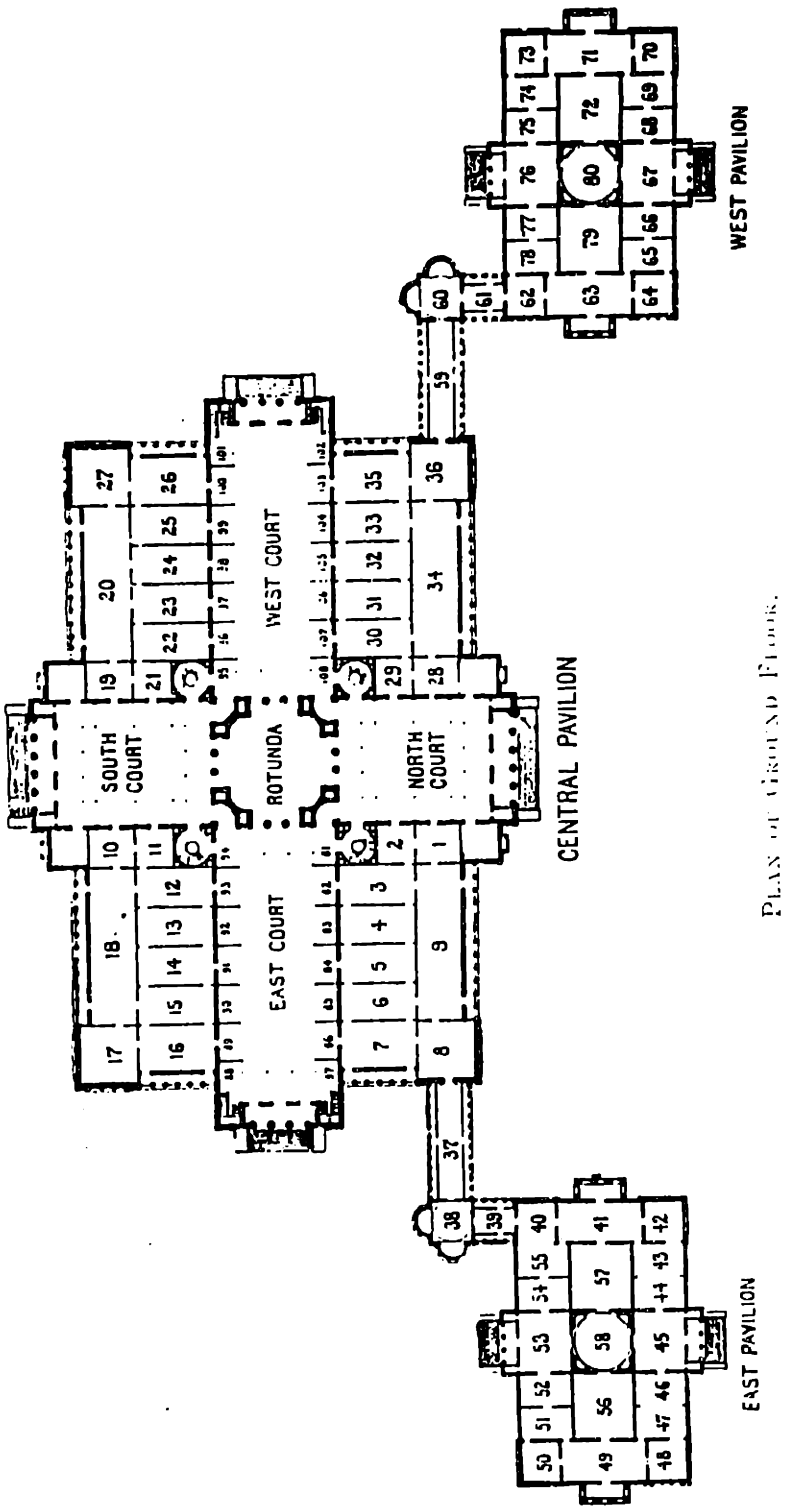
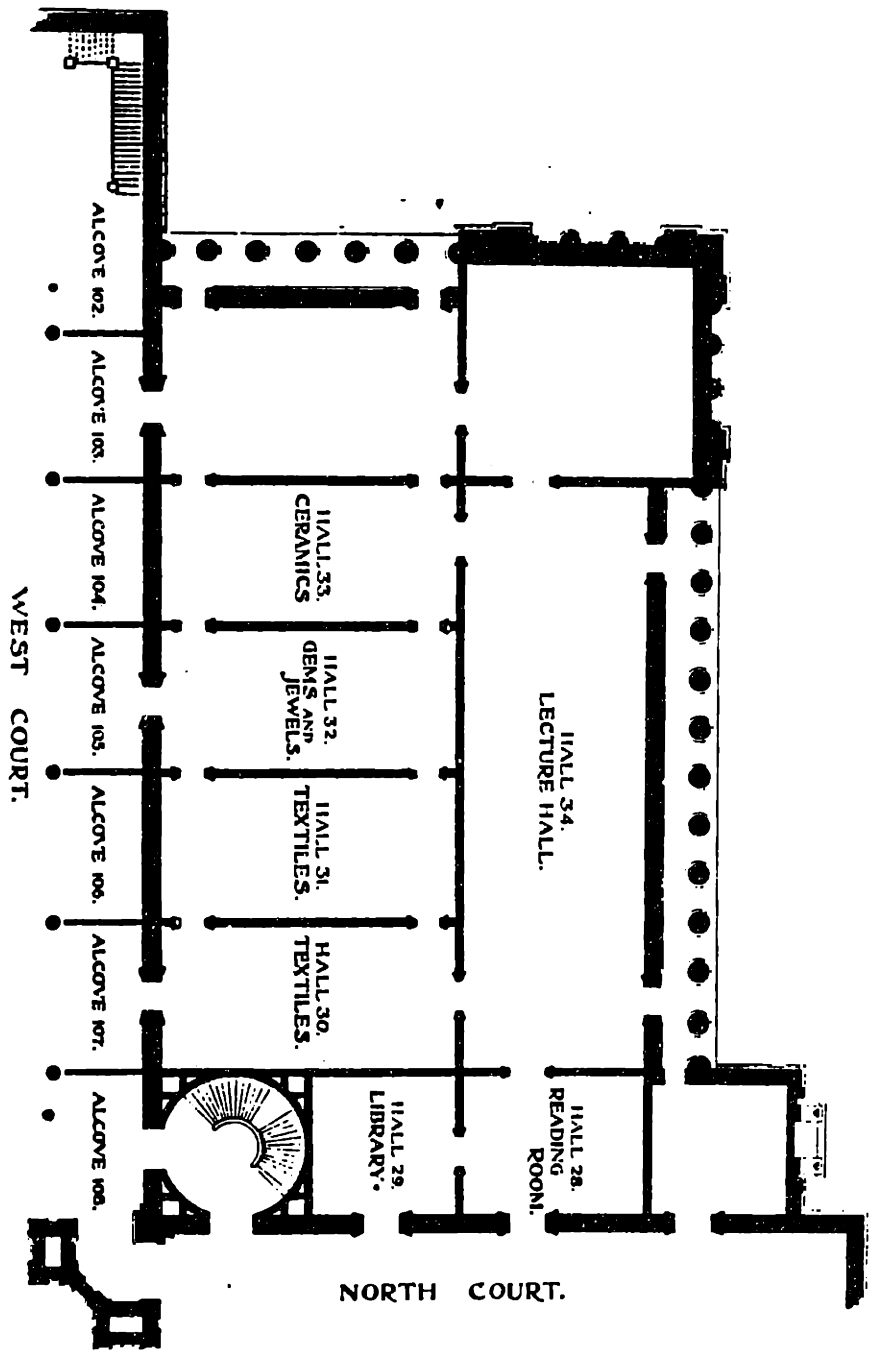


FIGURE 10.

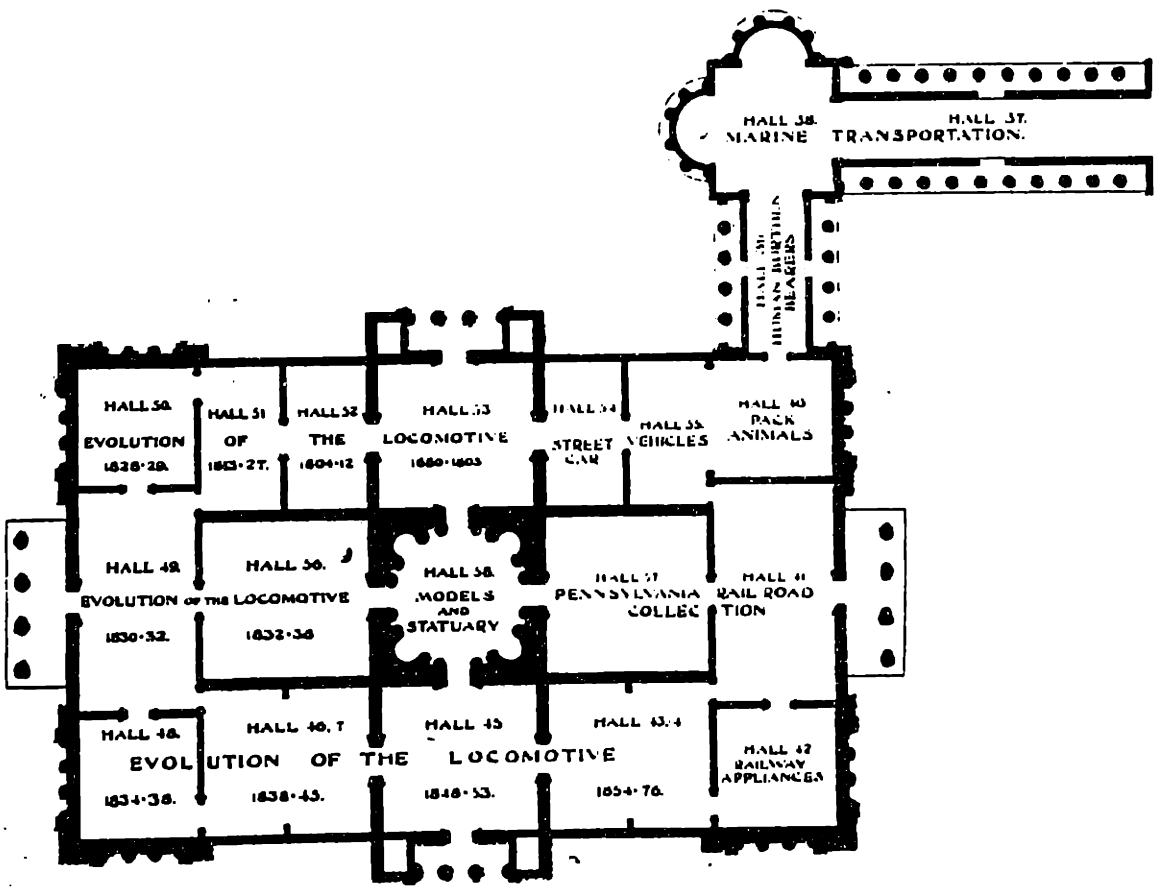
Floor Plan of the Industrial Arts Section, Field Columbian Museum, circa 1894.
[From Field Columbian Museum, *An Historical and Descriptive Account,* 1894.]



PLAN OF INDUSTRIAL ART SECTIONS, LIBRARY, ETC

FIGURE 11.

Floor Plan of the Transportation Section, Field Columbian Museum, circa 1894. [From Field Columbian Museum, *An Historical and Descriptive Account,* 1894.]



PLAN OF DIVISIONS OF TRANSPORTATION AND THE RAILWAY.

CHAPTER 6

Technology as the "Stepchild": A Permanent, if Subordinate, Presence for the USNM Technology Collections at the Turn of the Century

The technological collections to which J. Elfreth Watkins returned at the USNM in 1895 had not developed much, but they had remained intact. No overall philosophy or plan yet existed for the collection and preservation of the transportation and technology collections. Yet, Watkins had succeeded to a certain degree.

Watkins' Return, Renewed Efforts, and Renewed Struggle

Upon Watkins' return to the USNM in 1895, the Smithsonian had abolished the Department of Transportation and Engineering, and Watkins took charge of the new Department of *Technological* Collections.[1] At the end of 1894, he had written to George Brown Goode that, "in conformity with the verbal understanding of Nov. 2th, I have the honor to advise you that I now expect to report to the U.S. National Museum for duty on Wednesday am Jan'y 2d, '95."[2] The Smithsonian Secretary at that time, Samuel P. Langley, approved of Watkins' return.[3]

Nonetheless, Watkins, after more than ten years, still spent only a part of his time curating the technology collections. As before, he not only served as Curator of Technological Collections but also as Superintendent of Buildings.[4] Yet, despite his additional duties and his difficulties at the Field Museum in Chicago, Watkins still had extensive plans for his technological collections and continued the cultural negotiations that he had begun during his first stint at the Smithsonian. His first effort comprised an exhibit for the Atlanta Cotton States and International Exposition in

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[1]J. Elfreth Watkins, Report on Technological Collections, 1895, SIA, RU 158, Annual, Semi-Annual and Monthly Report of Departments, 1881-1897, Box 2, Folder 22.

[2]Watkins to George Brown Goode, December 29, 1894, SIA, RU 201, Assistant Secretary in Charge, Letters, Box 15, Folder 8.

[3]See Samuel P. Langley to Goode, January 27, 1895, SIA, RU 54, Assistant Secretary in charge of the United States National Museum (George Brown Goode), 1877-1896, Records, Box 2, Folder 12.

[4]See Dr. Benjamin, "For the Press [Obituary of Watkins]," SIA, RU 55, Assistant Secretary in Charge of the USNM (Rathbun), 1897-1918, Records, Box 12, General Correspondence, Folder 7, Waldren - Watkins. See also Langley to Watkins, February 6, 1895: SIA, RU 167, USNM, Chief Clerk and Administrative Assistant Records, 1885-1914, Box 10, Correspondence, Folder 2, Vol. 38.

1895. As early as January 1895, immediately upon his returning to Washington, he wrote to Goode with a plan for the Atlanta exhibit that relied on his extensive experience with exhibits at the Chicago fair. "As far as the Railway exhibit is concerned I believe a few hundred dollars would obtain material to sufficiently supplement what we now have in the collections," Watkins wrote in a letter accompanying his plan for Atlanta. "From my experience at Chicago I am convinced that the publication and distribution of a brief hand book of an exhibit is of great use to the press and public in attracting attention and affording information."[5] Watkins' plan comprised the following items:

Development of the Steamboat: in this class show vessels of historical interest such as a Columbus caravel --
- A. Rafts and Boats
- B. Sailboats and Ships

Steamboat and Steamship:
1. Age of conjecture
2. Fitch, Rumsey, Stevens, Fulton
3. The "Savannah"
4. Development for 75 years after Savannah

Beginnings of the American Railway:
- A. Track
- B. South Carolina RR
- C. Locomotives to 1831
- D. Track Since 1831
- E. Locomotives since 1831

Epoch-Making Inventions, with special reference to the Cotton States:
1. Whitney's Cotton Gin
2.
3. [6]

Watkins' plan for Atlanta comprised an overall history of technology emphasizing transportation that encompassed the key areas of development. He also continued to push for a place for "epoch-making" inventions. Although the department continued to lack artifacts in this area, Watkins' focus on inventions and progress established a paradigm that would be followed through most of the twentieth century.

Along with a new division name in 1895, Watkins received a number of new areas for supervision, all under the new domain of "Technology." In his 1897 report, he wrote that "the division of Technological Collections was organized February 1, 1895, with a view of completing

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[5]Watkins to Goode, January 1, 1895, SIA, RU 201, Assistant Secretary, Letters, Box 15, Folder 8.
[6]Watkins to Goode, January 1, 1895. Spaces for numbers 2 and 3 left blank in original document.

the study and arrangement of the several series then under control as well as the many unclassified objects acquired by the Museum during the centennial Exhibition at Philadelphia and since its close over twenty years ago." He attempted to devise an overall philosophy for the new group of objects, but his plans still suffered owing to administrative demands on his time and administrative emphasis on other collection areas. "Owing to the limited exhibition space at the command of the Curator many of these exhibits still remain or have been placed in storage," he reported in 1897. His additional duties "delayed the active prosecution of classification and labeling but such work as has been proceeded with has been done with the view of assembling together and preserving such objects as have had a marked influence upon our lives and habits in the development of civilization under the general category of the epoch making inventions."[7]

In 1897, Watkins developed a new classification scheme for the Technological Collections Department.[8]

A. Transportation and Engineering:
    1. Transportation by land: Vehicles without wheels; Vehicles with wheels.
    2. Transportation by water: Rafts and primitive drafts; sailing vessels; steamboats and steamships.
    3. Electrical Engineering: Telegraph; Telephone; Light and heat; Motors.
    4. Machines and appliances of historical interest.
B. Textiles: arranged to show the history of the art of weaving.
C. Animal Products: arranged to show the result of human effort in utilizing the products of the Animal kingdom.
D. Foods: arranged to show the adaptation of the products of the animal, vegetable and mineral kingdoms to supply food for man.
E. Physical apparatus: recently added, not under control.

The new scheme reflected the fact that several other collections, which had never been under Watkins' charge, came into his custody–and added to his workload. To a degree, it reflected George Brown Goode's broader view of "technology," including not only transportation, but also naval architecture, animal products, textiles, paints and dyes, foods, oils and gums, and chemical products.[9] [See Figure 1 for Floor plan of the Technology section of the National Museum.]

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[7]Watkins, Report for 1897, SIA, RU 158, Annual, Semi-Annual and Monthly Report of Departments, 1881-1897, Box 2, Folder 24. See Also RU 297, Box 1, Folder 9.

[8]Watkins, Report for 1897. See Also RU 297, Box 1, Folder 9.

[9]Goode, "Review of Work in Scientific Depts., Dept. of Arts and Industries, Technological collections," *USNM Report, 1896,* 92.

Since Goode directed the National Museum and Watkins reported to him, his views carried weight and Watkins had to take them into account.

Watkins' curatorial workload alone was heavy, to be sure. His curatorial responsibilities extended to include the physical apparatus collection upon the death of W. C. Winlock, who had been in charge of that collection. The USNM also turned over the Section of Marine Architecture to him in February 1895, as well as the catalogues of Textiles, Foods, and Chemicals in April of that year. William Holmes, head of Smithsonian Anthropology, noted that the museum had broadened the scope of the division of technology to encompass "all phases of handicraft," although he did not make it clear what objects that included.[10]

Yet, Watkins' administrative work remained the major drain on his time. George Maynard, who eventually took over the technology sections upon Watkins' death, noted a "lack of system and good order in this section" and blamed these problems on Watkins' inability to give total attention to the section.[11] Minor administrative details absorbed much of Watkins' time. In February 1895, for example, he wrote the report of a committee, which he chaired, that had been looking into the question of toilet rooms in the Smithsonian. Items such as ventilation, water closets, changes in stairways, smoke flues, elevators and airshafts preoccupied him in March 1895. In April, a museum official called him and others to a meeting "to take into consideration the subject of inks and type-writer ribbons most desirable for use in all the branches of the Institution." The rest of 1895 occupied Watkins with correspondence with the Smithsonian administration regarding such matters. In 1896, the correspondence moved on to the "installation of the new storage battery in connection with the electric light plant in the basement of the South Tower."[12]

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[10]See Charles D. Walcott, "Review of Work in Scientific Depts., Dept. of Arts and Industries, Technological Collections," *USNM Report, 1897,* 72; Watkins Report for 1895, SIA, RU 158, Annual, Semi-Annual and Monthly Report of Departments, 1881-1897, Box 2, Folder 22; and William H. Holmes, Head of Anthropology, "Report on the Department of Anthropology for the year 1903-1904," *USNM Report, 1904,* 75.

[11]George C. Maynard, History of the Division of Technology, SIA, RU 297, Division of Engineering, 1886-1956, Box 7, Records, Folder 1, September 1906. See also, Walcott, "Review of Work in Scientific Depts., Dept. of Arts and Industries. Technological Collections," *USNM Report, 1897,* 69.

[12]See Watkins, et al, to Langley, February 11, 1895, SIA, RU 31, Office of the Secretary (Langley), 1866-1927, Box 67, General Incoming Correspondence, 1888-1927, Folder 3, 1895; Watkins to Langley, March 2, 1895, SIA, RU 31, Office of the Secretary (Langley), 1866-1927, Box 67, General Incoming Correspondence, 1888-1927, Folder 3, 1895; W. C. Winlock [in charge of apparatus and machines used by the USNM] to R. I. Geare, Chief of Correspondence and Reports, April 9, 1895, SIA, RU 201, Assistant Secretary in Charge of the United States National Museum, Letters, Box 19, Folder 21; and Langley to Watkins, November 14, 1895, SIA, RU 31, Office of

In 1897, a new drain on Watkins' energy became apparent–Secretary Langley's obsession with aerial flight. Langley called on Watkins' mechanical expertise for his engine experiments.[13] Although Watkins enjoyed his time spent on this undertaking with Langley more than the administrative duties, both took time away from his curatorial duties.

Despite the problems, the technology collections expanded and gained support through Watkins' enduring work and mediation. By 1898, the Smithsonian library added a section on technology.[14] The annual reports also began to include articles on technological areas such as telegraphy and illumination.[15] In addition, as noted above in Chapter 4, the technological collections also began to receive some internal Smithsonian support from curator of ethnology Otis T. Mason. Mason and Watkins connected the technology and engineering collections to the ethnology collections, which held a more prominent place in the museum establishment. Anthropologists often considered man as distinguishing himself from his almost-human predecessor by the use of tools, or, in other words, technology.[16] Thus, technology, in the form of tools, related to anthropology. Mason, as an anthropologist, wrote on the "beginnings of invention" and "artificial implements," while Watkins wrote on ancient technology in such works as "The Transportation and Lifting of Heavy Bodies by the Ancients."[17] For Watkins and Mason,

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the Secretary (Langley), 1866-1927, Box 67, General Incoming Correspondence, Folder 3, 1895. Correspondence regarding the new storage battery continued into 1897. [See SIA, RU 31, Box 67, Office of the Secretary (Langley), 1866-1927, General Incoming Correspondence, Folder 4, 1896-1897.]

[13]See letters between Watkins and Langley in SIA, RU 31, Office of the Secretary (Langley), 1866-1927, Box 67, General Incoming Correspondence, 1888-1927, Folder 3, 1895, Folder 4, 1896-1897, Folder 5, 1898.

[14]Walcott, "Report upon the Condition and Progress of the US National Museum during the year ending June 30, 1898," *USNM Report, 1898,* 70.

[15]See G. Marconi, M. Inst. C. E., "Wireless Telegraphy;" William A. Anthony (former president of American Institute of Electrical Engineers), "Transatlantic Telephoning, The Remarkable Invention by which Dr. M. I. Pupin has Revolutionized the Transmission of Electricity;" William J. Hammer, "The Telephonograph," presented at the AIEE meeting, New York, February 28th, 1901; Walter Hough, "The Development of Illumination," *American Anthropologist* vol. iii (April-June, 1901). All reprinted in *Annual Report, Smithsonian Institution, 1901,* 287-298, 299-306, 307-312, 493-500.

[16]See Melvin Kranzberg and Carroll Pursell, Jr., "The Importance of Technology in Human Affairs," in *Technology in Western Civilization,* vol. I, 7-8.

[17]See Otis T. Mason, "The Birth of Invention," in *Annual Report, Smithsonian Institution, 1892,* 603-611. Mason wrote about "inventions, artificial implements, processes, and results." See also Mason, "Influence of Environment upon Human Industries or Arts," in *Annual Report, Smithsonian Institution, 1895,* 639-665, and Mason, *The Origins of Invention, a Study of Industry among Primitive Peoples,* The Contemporary Science Series (London, UK: W. Scott, 1895). For Watkins' work, see *Cassier's Magazine* XXXIII (December, 1898); reprinted in *Annual Report, Smithsonian Institution, 1898,* 615-619. In works such as this one, Watkins discussed how things could have been done in ancient times without machines, winches, pulleys, et cetera, since no record (archaeological or written or drawing) showed these items existing in ancient times in the Middle East.

history and development progressed from the ancient instruments–normally in the purview of ethnologists and anthropologists–to the modern industrial implements–not normally included in museums. According to Watkins, "happily for our race and time, the crack of the Egyptian slave master's whip and the weird cries in cadence of battalions of swarthy laborers, while tugging in unison to draw or hoist the monolith, has given place to the puffing engine and the rumble of revolving wheels."[18] This inclusion of modern technology within ethnology and anthropology at the USNM allowed the growth of technology collections within the museum setting. Yet it also laid the groundwork for the subordination of technology to those more traditional museum disciplines. This subordination may have been the compromise that Watkins used in his mediation between the two quite different worlds of technology and traditional museology.

The Death of George Brown Goode and the Reorganization of the USNM

1896 was a time of struggle for the technological collections and staff. First, one of Watkins' key supporters, George Brown Goode, died in that year, and Charles D. Walcott (1850-1927), a paleontologist, succeeded him as Assistant Secretary in Charge of the USNM. While Goode had been a scientist, he was best known for his work in museum administration. Samuel Langley, the Smithsonian Secretary at the time of Goode's death, noted that "his talents and the careful scientific training which he had received gave him a very prominent place as a zoologist, but as a museum administrator he was perhaps skilled above all others." Goode had advocated industrial and technological collections and exhibits, and, as such, supported Watkins' efforts. With Goode's death, Watkins lost a key individual who had been important to his mediations. In addition, Watkins' administrative duties expanded in 1896, with the duties of Curator of Physical Apparatus and head of the Division of Buildings and Superintendence.[19]

Charles Walcott, with Secretary Langley's consent, reorganized the USNM's departments, effective July 1, 1897. He divided the departments into three areas– anthropology, biology and

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[18]Watkins. "The Transportation of Heavy Bodies by the Ancients," 619.

[19]Langley, "Report of S. P. Langley, Secretary of the Smithsonian Institution, for the Year Ending June 30, 1897," *Annual Report, Smithsonian Institution, 1897*, 16, 30, 30. Goode died on September 6, 1896.

geology.[20] The reorganization greatly affected the DAI collections. According to Walcott, Goode had wanted to reorganize the staff and collections, and Walcott had based the reorganization on Goode's plans. However, in Goode's classification, man had been the "central figure." Other objects "both animate and inanimate, were regarded as his resources, and each of the arts resulting from utilization of these resources was assigned its proper place."[21] Walcott believed that,

> while this great anthropocentric scheme of classification, with its multiplicity of divisions, was of the highest utility in arranging and distributing the vast assemblage of objects in the Museum, it was recognized at the same time that the collections could readily be administered by the establishment of four principal scientific departments -- those of anthropology, zoology, botany, and geology.[22]

The new organization of USNM departments in 1897 comprised three major departments – Anthropology, Biology, and Geology. The Division of Technology ended up in the Anthropology Department.[23]

Since the USNM had folded the Technology Division into the Anthropology Department, Watkins wrote no more curatorial reports for the annual reports of the Institution.[24] The head curator of the Department of Anthropology wrote up any items of interest for areas under his charge. Walcott acknowledged in his report that divisions "which *had previously been conducted independently of one another*" were subjected to one of three head curators–in anthropology, biology, and geology. Whereas previously the curators in those areas, Watkins among them, had reported directly to the Assistant Secretary in charge of the USNM, they now had to go through the head of Anthropology.[25] With Walcott in charge of Anthropology, the technology collections

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[20]Charles D. Walcott, "Report upon the Condition and Progress of the US National Museum during the year ending June 30, 1897," in *USNM Report, 1897*, 3. In June of 1897, Walcott had written to Langley: "I have the honor to transmit herewith, for your consideration, a suggested organization of the scientific and administrative staff of the United States National Museum. If it meets with your approval, I would suggest that it go in force on the first of July, 1897." [Walcott to Langley, June 10, 1897, SIA, RU 56, Assistant Secretary, Acting (Charles D. Walcott), 1897-1898, Outgoing Correspondence, Box 1.] See also, "Under New Chiefs, The Museum Reorganized," *Washington Star* (October 6, 1897), in W. H. Holmes, *Random Records* (manuscript), SIA, RU 7084, William Henry Holmes Papers, Volume VII.

[21]Walcott, "Report upon the Condition and Progress of the US National Museum during the year ending June 30, 1897," *USNM Report, 1897*, 3, 5-6.

[22]Walcott, "Report, 1897," *USNM Report, 1897*, 6.

[23]"New Plan of Organization for Staff," *USNM Report, 1897*, 6-7.

[24]See SIA, RU 158, Annual, Semi-Annual and Monthly Report of Departments, 1881-1897, Box 21, Folder 1, *USNM Report, 1897*, and *USNM Report, 1898*.

[25]Walcott, "Report upon the Condition and Progress of the US National Museum during the year ending June 30, 1898," *USNM Report, 1898*, 3.

received little attention in subsequent reports. For example, "in the section of transportation and engineering the exhibition series is in fairly good condition, considering the limited space available," Walcott wrote in 1897. "No changes of importance have been made during the year."[26] In 1899 the general report of the head curator of Anthropology listed no technological items as "important collections received."[27]

Despite the subordination of Watkins and his department to Walcott and the Anthropology department, the technology collections continued to exist. At the time of the reorganization in 1897, Watkins prepared the following detailed classification of the technology collections at the USNM. [28]

Transportation and engineering:
- Transportation by land --
  - Vehicles without wheels
  - Vehicles with wheels
- Transportation by water --
  - Rafts and primitive crafts
  - Sailing vessels
  - Steamboats and steamships
- Electrical engineering
  - Telegraph
  - Telephone
  - Light and heat
  - Motors, stationary and for traction

Machines and appliances of historical interest.

The collection had now grown large enough to require a detailed organization, although ironically it occurred at the very time when its relative position declined in the overall pecking order of the museum.

A Second Engineer in George Colton Maynard

In 1896 Watkins received the assistance of George Colton Maynard (1838-1918), an electrical engineer and secretary of the Telegraphic Historical Society of North America and of the American Association of Inventors and Manufacturers, who joined the USNM staff as Custodian

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[26]Walcott, "Report, 1897," *USNM Report, 1897*, 24.

[27]William H. Holmes, "Report on the Department of Anthropology for the Year 1898-99," *USNM Report, 1899*, 18.

[28]Walcott, "Report, 1897," *USNM Report, 1897*, 70.

of Electrical Collections.[29] Just as Watkins had been a way into the museum for forces within the railroad, mechanical, and civil engineering groups outside the museum, Maynard became a conduit in for those in the electrical and telegraph fields. The door remained open, albeit smaller.

Maynard began his association with the USNM in an unofficial capacity as one of Watkins' outside supporters. He first appeared as official USNM staff in the 1896 National Museum Report as honorary Custodian of Electrical Collections.[30] W. V. Cox, Chief Clerk of the Museum, wrote to Maynard in 1897 that,

> in compliance with the application contained in your letter of May 25th, forwarded by the Curator of Technological Collections, with favorable endorsement, your name has been entered upon the Museum Pass List, and you will hereafter be permitted to enter the Smithsonian and Museum buildings when closed to the public, introduce friends who may accompany you, and carry packages out of the building containing personal property or objects belonging to the collection in your charge, subject to the rules governing Museum material.[31]

Maynard's key connections included ones to individuals in the electrical engineering community, a complement to Watkins' connections to railway and mechanical engineering. His outside connections appealed to USNM staff. In 1896, Assistant Secretary George Brown Goode wrote to Secretary Langley, on the advice of Watkins:

> I would recommend that Mr. George C. Maynard be appointed custodian of the electrical collections in the National Museum. Mr. Maynard is the secretary of the Telegraphic Historical Society of North America, member of the Old Times Telegraph society, of the Society of the U. S. Military corps, of the American Institute of Electrical Engineers; and foreign member of the Institution of Electricians, London, these being all of the associations interested in preserving the history of the telegraph. . . . He is thoroughly devoted to the Institution, and has already done much in securing instruments for the collections.[32]

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[29]Maynard was a well-known electrician and electrical engineer in the Washington, DC, area. [See "New Houses in Washington," *New York Times*, December 25, 1881: 4.] In addition, his family had become well-known for their relation to Charles J. Guiteau, President James Garfield's assassin. George Maynard and other of his relatives testified at Guiteau's trial regarding the possibility of mental instability in the family. In addition, the prosecutor questioned Maynard regarding money that he had loaned to Guiteau the day that Guiteau had allegedly purchased the weapon used in the assassination. [See "Proceedings in Court," *New York Times*, November 20, 1881: 2, and "Guiteau's Bad Character," *New York Times*, December 9, 1881:1.]

[30]"Staff," USNM *Report, 1896*, 108.

[31]Acting Chief Clerk to Maynard, Custodian of Electrical Collections, June 1, 1897, SIA, RU 167, USNM, Chief Clerk and Administrative Assistant Records, 1885-1914, Box 12, Correspondence, Folder 1, Volume 45.

[32]Goode to Langley, March 27, 1896, SIA, RU 54, Assistant Secretary in charge of the United States National Museum (George Brown Goode), 1877-1896, Records, Box 4, Volume 4.

Maynard's presence in the museum excited Watkins. He hoped that Maynard would build the electrical collections through his connections in the same way that he himself had built up the transportation collections. Assistant Secretary Walcott noted the assistance that Maynard had already provided in adding to the museum collections, and he saw "prospects for building up an interesting series of historic electrical apparatus."[33] Some of the early accessions that came through Maynard included items from Alexander Graham Bell, General Electric, the Coe Brass Manufacturing Company, the J. A. Roebling's Sons Company, and some original Morse telegraph equipment.

Like Watkins before him, Maynard sought support from outside the museum world through written requests for assistance and donations. In 1896, he wrote the inventor Charles F. Brush (1849-1929), of the Brush Electric Company:

> The authorities of the National Museum are desirous of enlarging the Electrical Collections of the Institution, by the addition of epoch-making inventions, illustrating the various important stages of the art which you have done so much to develop, and I am instructed to ask your co-operation in furtherance of that object. No doubt you have many things which would fill an important place in the historical exhibits. The Museum receives such objects either as a gift, deposit or loan. Upon receipt of a favorable reply from you, a more formal request will be made for such articles as you may wish to contribute to the Collections.[34]

Brush replied that he was trying to track down some of their early pieces for Maynard. By March 1897, Walcott, as head of Anthropology, made a formal request for an Ammeter, a Voltmeter, the first dynamo, and the first plating machine from the Brush Company.[35]

Maynard also wrote to the inventor Elihu Thomson (1853-1937) and requested assistance. In October 1896, Thomson responded favorably by writing that he had "no doubt that a proper electrical collection could be made for the National Museum which would show the early steps in electrical invention and industries, and which *should have a similar rank to those admirable collections which now exist in the National Museum in relation to other arts of not quite so modern*

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[33]Walcott, "Report, 1897," *USNM Report, 1897*, 69.

[34]Maynard to Charles F. Brush, Cleveland, November 12, 1896, SIA, RU 250, Division of Electricity and Modern Physics, 1886-1978, Records, Box 1, Folder 2. In the 1870s, Charles F. Brush had pioneered in carbon-arc lighting, a major electric lighting system before Thomas Edison and incandescent lighting.

[35]See C. F. Brush to Maynard, February 26, 1897, SIA, RU 250, Division of Electricity and Modern Physics, 1886-1978, Records, Box 1, Folder 2, and Walcott to Brush, March 15, 1897, SIA, RU 250, Division of Electricity and Modern Physics, 1886-1978, Records, Box 1, Folder 2.

a character."[36] Maynard responded to Thomson after Thomson expressed his willingness to assist. He assured Thomson that "the Director of the Museum fully appreciates your kind offer, and will be much pleased to have your co-operation."[37] The Museum formally requested donations from the General Electric Company, which held Thomson's devices, and subsequently received numerous items.

Maynard also took trips to see inventors and to ask for donations. For example, in late 1897, he traveled to Boston to collect electrical specimens. He visited General Electric, Brush Lighting, Elihu Thomson, members of the American Institute of Electrical Engineering, and Bell Telephone. Maynard's trip to Boston elicited support and donations from many of those persons and companies that he visited. John Hudson, President of Bell, "expressed much interest in the undertaking and a desire to do whatever he could to forward that object."[38] In addition, Langley reported:

> Prof. Alexander Graham Bell deposited a large number of pieces of apparatus made and used by himself in his experiments and researches, including a series illustrating the invention and development of the Bell telephone. The General Electric Company deposited several dynamos and other pieces of apparatus of great historical value. The Coe Brass Manufacturing Company, of Anxonia, Conn., presented ten dynamos made between the years 1873 and 1879 by William Wallace. . . . An electric generator made in 1867 by Mr. Charles A. Seeley and an electric motor devised in 1834 by Thomas Davenport were received on deposit from the American Institute of Electrical Engineers. Altogether, the pieces of electrical apparatus received represent nearly the entire range of American invention, forming the basis of the practical methods of electric arc and incandescent lighting. Duplicates of few, if any, of these machines exist.[39]

Maynard also wrote to various companies and inventors, asking for information on catalogues of devices and other objects.

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[36]Elihu Thomson to Maynard, October 30, 1896, SIA, RU 250, Division of Electricity and Modern Physics, 1886-1978, Records, Box 1, Folder 6. Emphasis added. Elihu Thomson was an inventor of electric light systems. In 1892, his company, the Thomson-Houston Electric Company, merged with Edison General Electric to form the General Electric Company.

[37]Maynard to Thomson, November 9, 1896, SIA, RU 250, Division of Electricity and Modern Physics, 1886-1978, Records, Box 1, Folder 6.

[38]Maynard to Watkins, October 21, 1897, SIA, RU 250, Division of Electricity and Modern Physics, 1886-1978 Records, Box 1, Folder 17.

[39]Langley, "Appendix I. Report on the National Museum," *Annual Report, Smithsonian Institution, 1898,* 32.

Maynard worked with new supporters within the Museum since the nature of the Museum administration and its Board of Regents had begun to change. On January 24, 1898, the famed inventor-citizen, Alexander Graham Bell, joined the Smithsonian Board of Regents. The National Museum used his connections with other inventors and industrialists to attempt to enlarge its collections. In 1901, Maynard wrote to W. H. Holmes, Head Curator, that "Alexander Graham Bell, being in close communication with Marconi, might be able to secure for the Museum collections some suitable pieces of Wireless Telegraph Apparatus."[40]

Watkins and Maynard worked closely together. With the reorganization of the Museum staff and departments, Maynard and his electrical collections came directly under Watkins' control. In April 1898, Museum administration informed Watkins that his section's name had changed from Section of Technology to Division of Technology (mechanical phases). They placed the Section of Electrical Collections, with Maynard as Custodian, under Watkins' charge.[41] Maynard eventually began to work with Watkins on the mechanical technology exhibits as well and became an Aid in the Division of Mechanical Technology in 1898.[42] In 1901, the museum promoted Maynard to Assistant Curator in the Technology Division.[43] Watkins and Maynard reinforced each other's desires for an exceptional and necessary technology and engineering collection and display at the USNM. They both attempted to mediate between the world they had come from and represented–engineering and technology–and the world they were in–museums.

Watkins' Death and Maynard's Struggles

In August 1903, John Elfreth Watkins died in New York City.[44] Watkins' obituary referred to him as "the great American authority on the history of mechanical arts."[45] For many

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[40]Maynard to W. H. Holmes, Head Curator, December 26, 1901, SIA, RU 201, Assistant Secretary in charge of the United States National Museum, 1875-1902, Letters, Box 11, Folder 2.

[41]Smithsonian Secretary Langley to Watkins, April 30, 1898, SIA, RU 167, USNM, Chief Clerk and Administrative Assistant Record, 1885-1914, Box 13, Correspondence, Folder 3, Volume 51.

[42]"History of the Electrical collections, and other items included in the Division of Technology, 1899," from *Annual Report, Smithsonian Institution, 1899,* 51, in SIA, RU 297, Division of Engineering, Box 4, Folder 11, Division of Technology Extracts from Annual Reports, 1896-1906.

[43]"Museum Staff," *USNM Report, 1901,* 93-94.

[44]Watkins Necrology, *USNM Report, 1904,* 56-57.

[45]Dr. Benjamin, "For the Press [Obituary of Watkins]," August 11, 1903, SIA, RU 55, Assistant Secretary

years prior to his death, Watkins had struggled with illness. His many years of illness on and off had required leaves of absence from his work at the Museum but had not diminished his pursuit of his goal.[46] In 1873, as noted above, an accident had disabled Watkins. It is unclear whether his disability contributed to his illnesses, but his overwork almost surely did. According to his obituary writer, "during recent years his strength was considerably taxed by the many duties which he assumed." In 1902, Watkins had traveled to New York for special treatment. In 1903, he returned again to New York to continue the treatment but died before it took much effect.[47]

While Watkins had not accomplished everything he had set out to do regarding technological collections in a museum setting, he nonetheless left an important legacy. By 1903, the USNM held enough of a technological collection that it provided a core foundation for later technologists and curators. Watkins also left behind his aide, George Maynard, who picked up where Watkins had left off. The objects, and those personnel who cared for them, held a permanent, if background, place at the Museum. Without Watkins' efforts, the nineteenth-century technology collections of the Smithsonian museums would be lacking and the Museum of History and Technology would not have had substantial technology collections when the Smithsonian created it in the 1950s.[48] [See Figure 2 for Floor plan of the National Museum, circa 1903.] A

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in Charge of the USNM (Rathbun), 1897-1918, Records, Box 12, General Correspondence, Folder 7, Waldren - Watkins.

[46]See SIA, RU 297, Division of Engineering, 1886-1956, Records, Box 1, General Correspondence and Outgoing Correspondence, Folder 1, William V. Cox, Chief Clerk, 1886-1892. Watkins requested and was approved for numerous leaves of absence during 1888, 1889, and 1891. The actual details and cause of Watkins' frequent illnesses is not discussed or described in the correspondence. There is some sense that it may have had to do with his earlier accident and loss of limb, but this is not explicit. See also SIA, RU 167, USNM, Chief Clerk and Administrative Assistant Records, 1885-1914, Box 10, Folder 2, Vol. 38, and Folder 4, Volume 40, for leaves of absence after Watkins' return to the USNM in 1895 and 1896. According to the minutes adopted at a meeting of Smithsonian officers and employees in 1903, Watkins "pursued his scientific and administrative labors under physical infirmities which would have crushed the ordinary man." ["Minutes adopted at a meeting of the officers and employees of the Smithsonian Institution held on August 12, 1903, to take action pursuant to the death of Doctor J. Elfreth Watkins," SIA, RU 55, Assistant Secretary in Charge of the USNM (Rathbun), 1897-1918, Records, Box 12, General Correspondence, Folder 7, Waldren - Watkins.]

[47]Dr. Benjamin, "For the Press [Obituary of Watkins]," SIA, RU 55, Assistant Secretary in Charge of the USNM (Rathbun), 1897-1918, Records, Box 12, General Correspondence, Folder 7, Waldren - Watkins.

[48]The USNM was split into two administrative subdivisions, the Museum of History and Technology and the Museum of Natural History, in 1957. The Museum of History and Technology consisted of the departments of Science and Technology, Arts and Industries, Civil History, and Armed Forces History. [See *Annual Report, Smithsonian Institution, 1958*, 43.] The Museum of History and Technology was renamed the National Museum of History and Technology in 1969, with the departments of Applied Arts, Cultural History, Industries, National and Military History, and Science and Technology. [See *Annual Report, Smithsonian Institution, 1969*, 59.]

paradigm for historical work also appeared as an important legacy from Watkins. Watkins' writing formed a sample of early history of technology. Watkins, and the Smithsonian technology curators after him, also influenced the burgeoning field of the history of technology in the twentieth century. Much written history of technology well into the twentieth century mirrored Watkins' interpretations of technological history as progressive and as defined by a series of epoch-making inventions and their inventors.[49]

In 1904, the Museum abolished Maynard's Section of Electricity and placed him in charge of the entire technology division.[50] Maynard received no more administrative support than Watkins had, and he inherited the struggles of the division. The Division of Technology dropped in the number of accessions it received in 1904-1905.[51] Moreover, while almost every other division in the Museum had separate study series and exhibition series, the Division of Technology still did not.

The concept of "technology" itself also remained a problem. In Maynard's opinion, "when the collections now in the Division [of Technology] came into my charge, they were in a state of much confusion and uncertainty." Consequently, uncertainty existed as to what collections belonged to the Division. The objects in the departments of Musical Instruments, Pottery and Porcelain, Paints and Dyes, Oils and Gums, Chemical Products, Animal Products, Foods, Domestic Animals, Fisheries and Textiles, according to Maynard, had "never been under the care of the old section of Transportation and Engineering nor the Division of Mechanical Technology."[52] Maynard felt it necessary to make clear the objects for which he and his division had responsibility. Most of the named sections had been in the old Department of Arts and

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[49]For more information on this legacy from Watkins and the Smithsonian's continued role in the field of the history of technology–as well as the first professional society in the field–see Chapter 8.

[50]Langley, "Report of the Secretary," *Annual Report, Smithsonian Institution, 1904*, 56, in SIA, RU 297, Division of Engineering, Box 4, Folder 11, Division of Technology Extracts from Annual Reports, 1896-1906.

[51]Mason, Department of Anthropology Report, 1904-05, SIA, RU 158, Annual, Semi-Annual and Monthly Reports of Departments of the USNM, 1881-1897, Box 26, Folder 16. The Division received three Langley aerodromes, some watches and watch movements, firearms, incandescent electric lamps, more railway appliance, and some pieces of telegraphy.

[52]Mason, Department of Anthropology Report, 1904-05, SIA, RU 297, Division of Engineering, Records, Box 4, Annual and Quarterly Reports and Division Histories, 1895-1956, Folder 3, Division of Technology, 1903-1904.

Industries which Walcott had abolished. Technology was not the only collection that lost its place in the reorganization.

Maynard tried to continue in the patterns of negotiation, mediation and representation that Watkins had established for the Division. In 1891, when the Patent Centennial celebration occurred in Washington, Watkins had used it to present and add to the museum's technology collections. In 1904, when a large delegation of foreign electrical engineers visited Washington for a meeting of the American Institute of Electrical Engineers (AIEE), Maynard prepared an exhibit of objects that might interest the members and placed them in the Smithsonian Lecture Hall. Several AIEE members visited the exhibit. In 1905, the International Railway Congress and the American Railway Appliance Association held meetings in Washington, DC. At that time, many of the international participants at the Congress visited the railway division at the museum and studied its arrangement and labeling.[53]

Maynard continued to receive some support from Otis Mason as Watkins had. In 1903, Mason moved into a position from which he could further aid the technology collections when he succeeded William H. Holmes as head of the Anthropology Department. Mason pointed out what many previous administrators had ignored: the technology collections interested the public and drew large numbers of visitors to the Museum, both amateur and professional.[54] "All of the collections of the Division of Technology have been examined by numerous investigators," he reported in 1907. He also noted:

> In October, 1906, when the annual meetings of several national telegraph organizations were held in this city, many of the members visited the division to study the historical telegraph collections. In May, 1907, members of the National Electric Light Association, in attendance at its annual convention, gave special attention to investigations of the electrical collections, which embrace many pieces of apparatus showing the beginning of various branches of the industry. . . . Delegations and parties of excursionists from numerous technical schools and colleges, engineering and industrial societies, and other organizations, both American and foreign, many of them under the guidance of instructors, have visited the Division for the express purpose of studying the collections pertaining to the art or industry in which they were especially interested. During the year an unusual

[53]Mason, Department of Anthropology Report, 1904-05, SIA, RU 158, Annual, Semi-Annual and Monthly Report of Departments, 1881-1897, Box 26, Folder 16.

[54]Mason, Department of Anthropology Report, 1906-07, SIA, RU 158, Annual, Semi-Annual and Monthly Report of Departments, 1881-1897, Box 26, Folder 18.

> interest has been manifested in the history of the beginning and development of steam navigation, as well as of the vessels employed in the discovery of America and in the Colonial times, and inquiries for information on these subjects, with requests for descriptions and photographs of models of boats in the collections have been frequent.[55]

Mason's attention proved important, but it also reinforced the idea that technology formed a part of anthropology. Maynard saw the technological collections as something very different.

Maynard advanced Watkins' ideas regarding the culture of technology and its representation in museums. He used assistance from forces and groups outside the museum, but he also tried to work within museum administration and defined roles. After twenty years of haphazard collecting in the area of technology, the museum needed to specifically define technology. According to Maynard and the "Standard Dictionary" of his day:

> The term Technology, as used to define the purpose of the National Museum in making appropriate collections and arranging exhibits for the examination and study of the general public, is understood to embrace
> 1. The science that treats of the facts and principles of the industrial arts; theoretical knowledge relating to industries and manufactures, such as metallurgy, brewing, weaving, building, etc.;
> 2. Anthropology: the branch of ethnology which treats of the rise and development of the arts. It embraces the study of (1) the utilitarian arts, relating to manufacture, architecture and building, clothes and fashions, means of transportation, agriculture, the domestication of plants and animals, and weights, measures, and the media of exchange; and (2) the aesthetic arts, as decoration (including skin-painting and tattooing), sculpture, painting, music, and dancing;
> 3. The application of scientific knowledge, as in chemistry, mechanics, etc., to the arts or to some particular art, as the technology of weaving.[56]

Maynard's view of technology centered on the idea of "progress," just as Watkins' view had. Maynard wanted the exhibits to "be arranged in systematic groups in such manner that they will clearly illustrate the history of the beginning and development of the various handicrafts, industries and mechanical arts, from the earliest and most primitive device, implement or method, to the highest development of modern times." He, like Watkins and Mason, also used the connection of the ancient arts to technology to push for the further development of the modern technology collections. Maynard further argued that the exhibits following technological development needed

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[55]Mason, Department of Anthropology Report, 1906-07, SIA, RU 158, Annual, Semi-Annual and Monthly Report of Departments, 1881-1897, Box 26, Folder 18.

[56]Maynard, History of Division of Technology, circa 1906 (notes), SIA, RU 297, Division of Engineering, 1886-1956, Box 7, Records, Folder 2.

to be "kept up to date throughout the future." With this plan in mind, Maynard conducted the work of the Division of Technology.[57] According to his definition, however, anthropology was a branch of technology rather than technology being just one part of anthropology.

Despite his beliefs, Maynard continued to work within the accepted views of the USNM. Maynard reorganized the exhibits of the Division of Technology in 1905 and based the classification on the objects that he found in the collections of which he had charge. He classified the objects as follows:[58]

1. Land Transportation
2. Water Transportation (Naval Architecture)
3. Aerial Navigation
4. Electrical Industries. Telegraphs. Telephones. Electric Light. Electric Power. Electric Heating, etc.
5. Talking Machines
6. Writing Machines
7. Metrology, Horology (measurement)
8. Gunnery
9. Agriculture
10. Miscellaneous, objects relate to other subjects which are receiving attention and undergoing development.

Maynard recognized how the technology collections that he inherited had come together–by chance, not design. *"The introduction of this subject into the National Museum was not by design, but was forced upon the institution by the bringing into it of technological objects secured from time to time in connection with the collection of specimens relating to other subjects,"* he wrote.[59] Technology had slipped in the back door of the museum and stayed. With the foundation of a well-organized and better-defined collection, Maynard tried to expand the scope of the Division and to add substantially to its collections.

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[57]Maynard, History of the Division of Technology, SIA, RU 297, Division of Engineering, 1886-1956, Box 7, Records, Folder 1, September 1906.

[58]U. S. National Museum, Department of Anthropology, Division of Technology, Sept. 12, 1905, SIA, RU 297, Box 7, Division of Engineering, 1886-1956, Records, Folder 3, Organization of the Division of Technology, 1900-1905.

[59]Maynard, History of the Division of Technology, SIA, RU 297, Division of Engineering, 1886-1956, Box 7, Records, Folder 1, September 1906. Emphasis added.

The Patent Models

In 1908, the US Government patent model collection finally found its home in the USNM technological collections. The patent system had proved a key component to the development of technology in the United States; yet the patent models had not been a part of the national technology collections. Through Maynard's negotiation and mediation, America's inventor-citizen finally found a place in the National Museum, although this inclusion occurred more than sixty years after the museum's founding.

In June 1906, Maynard went to the US Patent Office to examine nearly one hundred and fifty-five thousand models on exhibit there. The models had mostly been presented in connection with applications for patents that the office had granted. They also included models that the Patent Office had made to exhibit at the international expositions and that represented early historic inventions.[60] Maynard decided that about twenty-five percent of the objects would be valuable additions to the USNM technology collections. He wrote to the Assistant Secretary:

> There are a considerable number of well made models, representing important steps in the history of the development of various arts, which would be of much value to the Institution. The classes of models which contain specimens of the most interest to the Museum are those relating to weaving, spinning, knitting, harvesting, paper-making, printing, electric lighting, telegraphy, telephony, measuring apparatus, mechanical movements, railway locomotives, steam governors, typewriting machines, sewing machines, calculating machines, gunnery, etc.[61]

Maynard then began a process of acquiring a number of these models and deemed it a "matter of importance that desirable objects should be secured."[62]

Some administrative effort existed on behalf of the museum to obtain the Patent collections. In 1906, William de C. Ravenel, Administrative Assistant to the Smithsonian Secretary, wrote to the Secretary of the Interior that "there are in the Patent Office model exhibit a considerable number of objects representing important steps in the history of the development of various arts and industries, which would be exceedingly valuable for additions to the Museum collection for the interest and enlightenment of the hundreds of visitors who daily visit the Museum or the study of

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[60]Maynard to Richard Rathbun, Assistant Secretary, June 29, 1906, SIA, RU 192, USNM, Permanent Administrative Files, 1877-1975, Box 56, Folder 4.

[61]Maynard to Rathbun, June 29, 1906.

[62]Maynard to Rathbun, June 29, 1906..

such matter." The Museum made a formal request for a donation of the models, although it would not pay for them. Ravenel wrote further that "if it be decided to dispose of part or all of the models, otherwise than by sale, it is earnestly requested that such models as are of value for addition to this interesting feature of the Museum, be turned over to the Institution to form a part of the National Collections."[63]

With the efforts to transfer these items from the Patent Office to the USNM came a change of tone from the Museum administration regarding technology and invention collections. Maynard had pointed out that the museum had gathered its early collections of technology without design; however USNM administration differed. W. de C. Ravenel, Smithsonian Administrative Assistant in 1906, wrote "the National Museum has from the beginning been actively engaged in the formation of a collection of objects showing the development of technological industries."[64]

The changed view of administration involved several factors: the plans for an additional museum building, continued outside pressure from Congress, and public enthusiasm for such exhibits. In 1911, a new building for the natural history collections opened and the Arts and Industries Building remained for the collections forming the old Department of Arts and Industries. Richard Rathbun, Assistant Secretary in charge of the USNM, wrote to the Secretary of the Interior, Thomas Ryan, in 1906, that, "upon the completion of the new Museum building, it is the purpose to devote the present one to the display of the collections embraced in the Department of Arts and Industries, and any models received from the Patent Office will be incorporated with these collections and will be placed on exhibition for the instruction and entertainment of the public."[65] Museum administration used the opening of the new building to justify the transfer of the patent models from the Patent Office to the USNM. According to Ravenel, the Patent collection would receive "even greater attention when the new Museum building, now under construction, is ready for occupancy."[66] In the view of Acting Smithsonian Secretary Richard Rathbun, "the

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[63]W. de C. Ravenel to the Secretary of the Interior, July, 1906, SIA, RU 192, USNM, Permanent Administrative Files, 1877-1975, Box 56, Folder 4.

[64]W. de C. Ravenel to the Secretary of the Interior, July, 1906.

[65]Rathbun to Thomas Ryan, Secretary of the Interior, August 4, 1906, SIA, RU 192, USNM, Permanent Administrative Files, 1877-1975, Box 56, Folder 4.

[66]W. de C. Ravenel to Secretary of the Interior, July, 1906.

Smithsonian Institution will be very glad to obtain some of the [Patent] models . . . to add to the Department of Technology in the National Museum." Rathbun promised that the Museum would give the currently restricted department a broader and more comprehensive foundation with the completion of the new building.[67]

Even with the new space allotted, USNM administration acceptance of the new collections required outside pressure from Congress. The Legislative, Executive and Judicial Appropriation Act, dated May 22, 1908 stated: "That a commission, which is hereby created, to consist of the Secretary of the Interior, the Commissioner of Patents, and the Secretary of the Smithsonian Institution, shall determine which of the models of the Patent Office may be of possible benefit to patentees or of historical value, such models thus selected to be cared for in the new National Museum building." In 1909, Secretary Walcott wrote to the Speaker of the House of Representatives: "In pursuance of the above requirement of law, such models as were deemed of historical value have been selected and transferred to the custody of the United States National Museum, for exhibition with the National collections."[68] The Patent Office collection, however, did not end up in the new building.

Over time, Smithsonian administrations proved unable to ignore the appeal of the large audiences that the technology collections could draw. Increased attendance brought the possibility of increased Congressional funding and funding for additional buildings as well as increased attention to the institution and its work. Despite all the efforts of Smithsonian administrators and scientists, the machines in the Smithsonian collections–particularly the locomotives and engines–drew in large numbers of the curious, just as earlier cabinets of curiosities and popular exhibits at world's fairs had.

The actual transfer of the Patent collection took place in 1908 after Maynard's recommendation regarding which items to accept. In June 1908, Smithsonian Secretary Charles Walcott wrote to Edward B. Moore, Commissioner of Patents, regarding "the removal to the

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[67]Rathbun, Acting Secretary, to Thomas Ryan, Acting Secretary of the Interior, July 17, 1906, SIA, RU 192, USNM, Permanent Administrative Files, 1877-1975, Box 56, Folder 4.

[68]Walcott to Speaker of the House of Representatives, February 25, 1909, SIA, RU 192, USNM, Permanent Administrative Files, 1877-1975, Box 56, Folder 3.

National Museum of certain models, some two thousand or more in number, which were selected a short time ago as appropriate to be incorporated in the Museum collections." Walcott designated Maynard "to directly represent the Museum and take charge of the actual transfer of the collection."[69] Moore responded that the Patent Office was currently transmitting the models to the USNM.[70] After effecting the transmission of an initial two thousand objects, Maynard attempted to secure more objects. He suggested to Ravenel, Smithsonian Administrative Assistant, "the importance of securing, at the proper time, a considerable number of additional objects." Items such as cash registers, ships' compasses, knitting machines, presses, stump pullers, sewing machines, and electrical apparatus particularly interested Maynard.[71] He wrote:

> The collection in the Patent Office embraces quite a number of models not related to any patents, but which have been made to illustrate important steps in the early history of the development of certain arts and industries. Among these there are models of ancient Roman and Egyptian machines and other historical devices. These will be valuable to the Museum and are included in my list. Many of the objects designated as 'models' are really complete, operative, serviceable machines and devices. In the Firearms section there are many complete rifles, muskets, revolvers, pistols, etc., and my recommendation is that all of these be secured if possible.[72]

The objects that the USNM Division of Technology eventually received were numerous. In addition to the models that had accompanied patent applications, the Patent Office collections included some full-sized examples of interesting inventions transferred from the Patent Office."[73] The collection also encompassed fire-arms, steam machinery, printing presses, sewing machines, typewriters, electrical inventions, telegraphy, locks, looms, spinning and knitting machinery, and locomotive models.[74]

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[69]Walcott to Edward B. Moore, Commissioner of Patents, June 10, 1908, SIA, RU 192, USNM, Permanent Administrative Files, 1877-1975, Box 56, Folder 3.

[70]Moore to Walcott, June 11, 1908, SIA, RU 192, USNM, Permanent Administrative Files, 1877-1975, Box 56, Folder 3.

[71]Maynard to W. de C. Ravenel, Administrative Assistant to Secretary, June 18, 1908, SIA, RU 192, USNM, Permanent Administrative Files, 1877-1975, Box 56, Folder 3.

[72]Maynard to Rathbun, August 6, 1908, SIA, RU 192, USNM, Permanent Administrative Files, 1877-1975, Box 56, Folder 4.

[73]"Collections, Department of Anthropology," *USNM Report, 1908*, 35. The accession number for the Patent collection was 48, 865.

[74]Mason, Report for 1907-08, SIA, RU 158, Annual, Semi-Annual and Monthly Report of Departments, 1881-1897, Box 26, Folder 19.

In 1908, the "inventor-citizen" finally held a place in the National Museum of the country he had built–the United States. A non-attributed, non-dated document in the Smithsonian Archives stated:

> The National Museum has had for many years a department of arts and industries, in which special attention has been given to preserving noteworthy American investions [sic] and to illustrating their development for the use of the public. This department of the Museum, it is intended, will be greatly enlarged upon the completion of the new Museum building, it being the purpose to devote the present building entirely to the subject of arts and industries. Any models received from the Patent Office will be incorporated in these collections and placed upon exhibition, and will thus be *permanently embodied as a record of the development of American invention in the national collections.*[75]

The new building allowed the old arts and industries collections to finally have a permanent place of their own. Yet, while the USNM technological collections did have a place in the museum by the time the new building opened in 1911, it remained far from a prominent place.

The Legacy from the Era of Watkins and Maynard

The views of later technology curators at the Smithsonian shed some light on the real legacy of the new building for the technology collections and the work of Watkins and Maynard. When the natural history collections moved to their new building across the mall in 1911, the Smithsonian staff left the technological collections behind in the Arts and Industries Building. They had become numerous, through the diligent striving of Watkins and Maynard, but they remained the "stepchild" of the science and natural history collections. In the words of Frank Taylor (1903-), a twentieth-century technology curator at the USNM, the Museum focused entirely on natural history, biology, geology, and anthropology. Taylor stated:

> Where I came to work [in 1922] was in the old Arts and Industries Building which was *practically abandoned* when the 'new museum,' so called [Natural History Building], was built and came into being about 1911. . . . The collections were moved from the old Arts and Industries Building to that building, and the Arts and Industries Building was left in *an almost wrecked condition.* The new building and the incentives to develop the natural science programs made that the glamour area. Our part of the National Museum, which consisted of very little, the division of

[75]Unsigned document, SIA, RU 192, USNM, Permanent Administrative Files, 1877-1975, Box 56, Folder 4. The document is most likely circa 1907/08 because of the reference to the patent model collection. The document was located among correspondence between Maynard, Rathbun, and the Secretary of the Interior. Thus the most likely author is Rathbun or Maynard.

> history, the division of mechanical technology, the division of mineral technology, and the section of textiles, was a very *insignificant* part of the National Museum and had very little attention or sympathy from anyone in administrative positions. We weren't 'understood,' we were thought of as antiquarians and people who just collected objects for the sake of collecting.[76]

After all of Watkins' efforts, the place of the technological collection remained quite subordinate.

Taylor gave primary credit for the existence of the technology collections, such as they were, to Watkins and Maynard. He described Maynard as "very active in telegraph and telephone communication, and while he was at the Smithsonian he was superintendent of the first telephone company in Washington." Maynard "had collected the definitive collections of telegraph instruments and telephones," as well as "material that had been collected from [Alexander Graham] Bell's laboratories." Watkins had been responsible for the transportation materials. Regarding Watkins, Taylor stated:

> The division of ethnology had collected Indian transportation devices and to this had been added some models of early railroad locomotives. This was under the direction of . . . J. Elfreth Watkins, who had been the Pennsylvania Railroad commissioner for the Columbian Exposition in Chicago. He had put together a collection of early locomotives and exhibits for that, and some of those came to the Smithsonian. J. Elfreth Watkins also came and was the superintendent of buildings as well as a curator of transportation![77]

Taylor, while acknowledging the work Watkins had done for the technology collections, also acknowledged that administrative and curatorial work had overloaded Watkins.

After more than fifty years, science remained the priority of the Smithsonian and its personnel. According to Taylor, in the Arts and Industries Building, "we were working with practically nothing, our budget was tiny, our staff was small, our surroundings were fairly miserable, and we had to build this up with a bootstrap operation which is what we felt we were involved in." A split occurred between the personnel in the Arts and Industries Building and those in the new Natural History Building. The Natural History Building and its collections remained the priority for the Smithsonian administration, but the collections in the Arts and Industries Building proved more popular with the public.[78]

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[76]Frank A. Taylor, interview by Miriam S. Freilicher and William Deiss, January 30, 1974, interview 1, transcript. SIA, RU 9512, Oral History Project, Box 1. Emphasis added.

[77]Taylor, interview 1, January 30, 1974.

[78]Frank A. Taylor, interview by Miriam S. Freilicher and William Deiss, February 6, 1974, interview 2,

Despite the lack of administrative support within the museum, Watkins, Maynard, and forces outside the museum managed to negotiate a place for enough of a collection that it now held a permanent, if subordinate, place at the institution. The deaths of Goode and Watkins hurt the development of the collections, but Maynard's work kept the door open with the continued brokering of technology. In the early part of the twentieth century, although the technology collections at the USNM remained far from center stage, they continued to grow and draw large crowds of visitors. Smithsonian administration could not ignore this draw of the technology collections which brought attention to the institution. Nonetheless, without the work of J. Elfreth Watkins at the end of the nineteenth century and later George C. Maynard, there would have been no foundation upon which to build the USNM technological collections in the latter half of the twentieth century to appeal to large public audiences. By the turn of the twentieth century, through cultural negotiation and outside pushes, enough technology had slipped in the Smithsonian's back door to keep that door open well into the twentieth century.

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transcript, SIA, RU 9512, Oral History Project, Box 1.

FIGURE 1.

Diagram of Exhibits in the East Hall, National Museum, circa 1900.
[Courtesy of the Smithsonian Institution Archives, Record Unit 297, Division of Engineering, 1886-1956, Records, General Correspondence and Outgoing Correspondence, Box 7, Folder 4.]

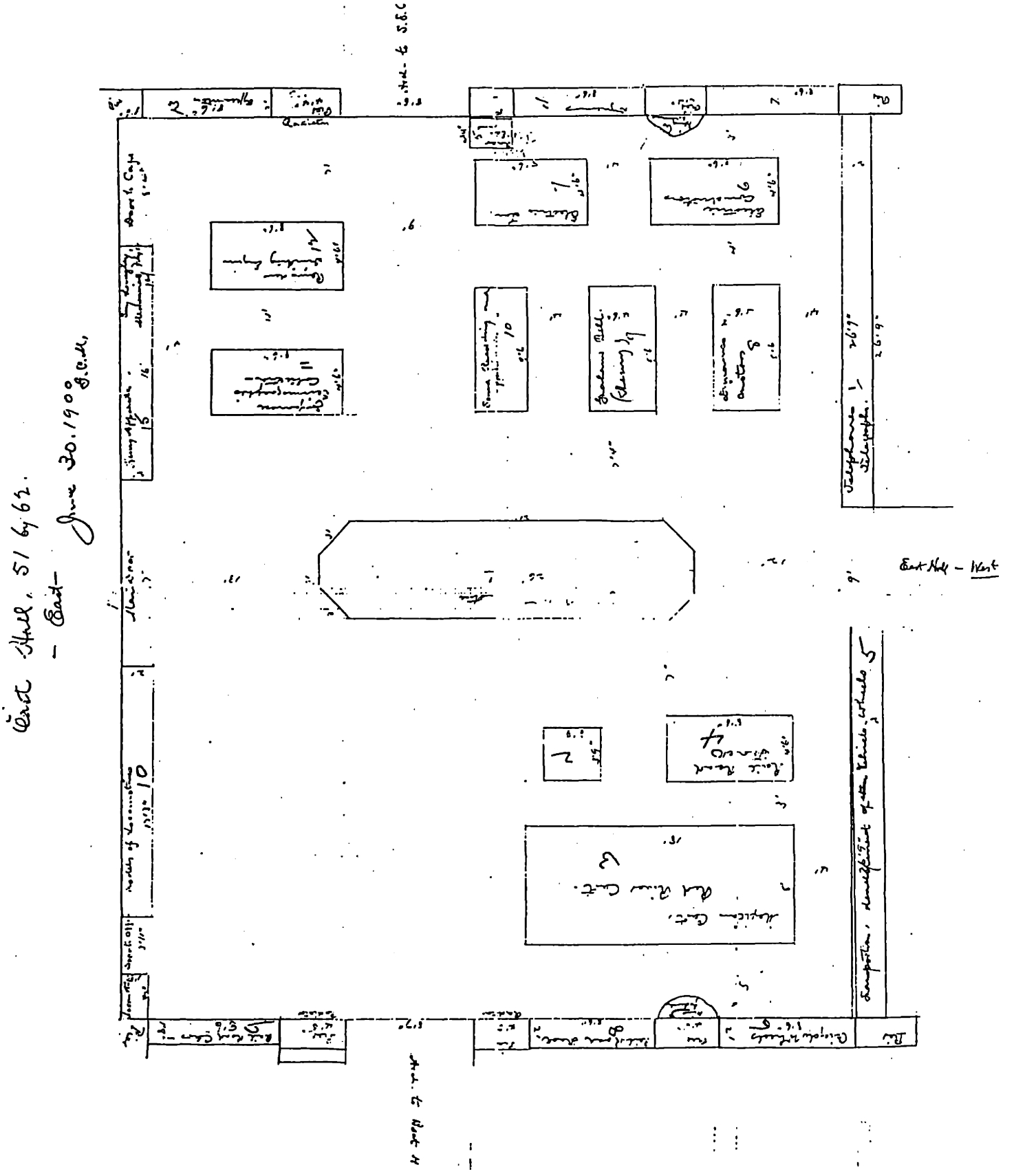
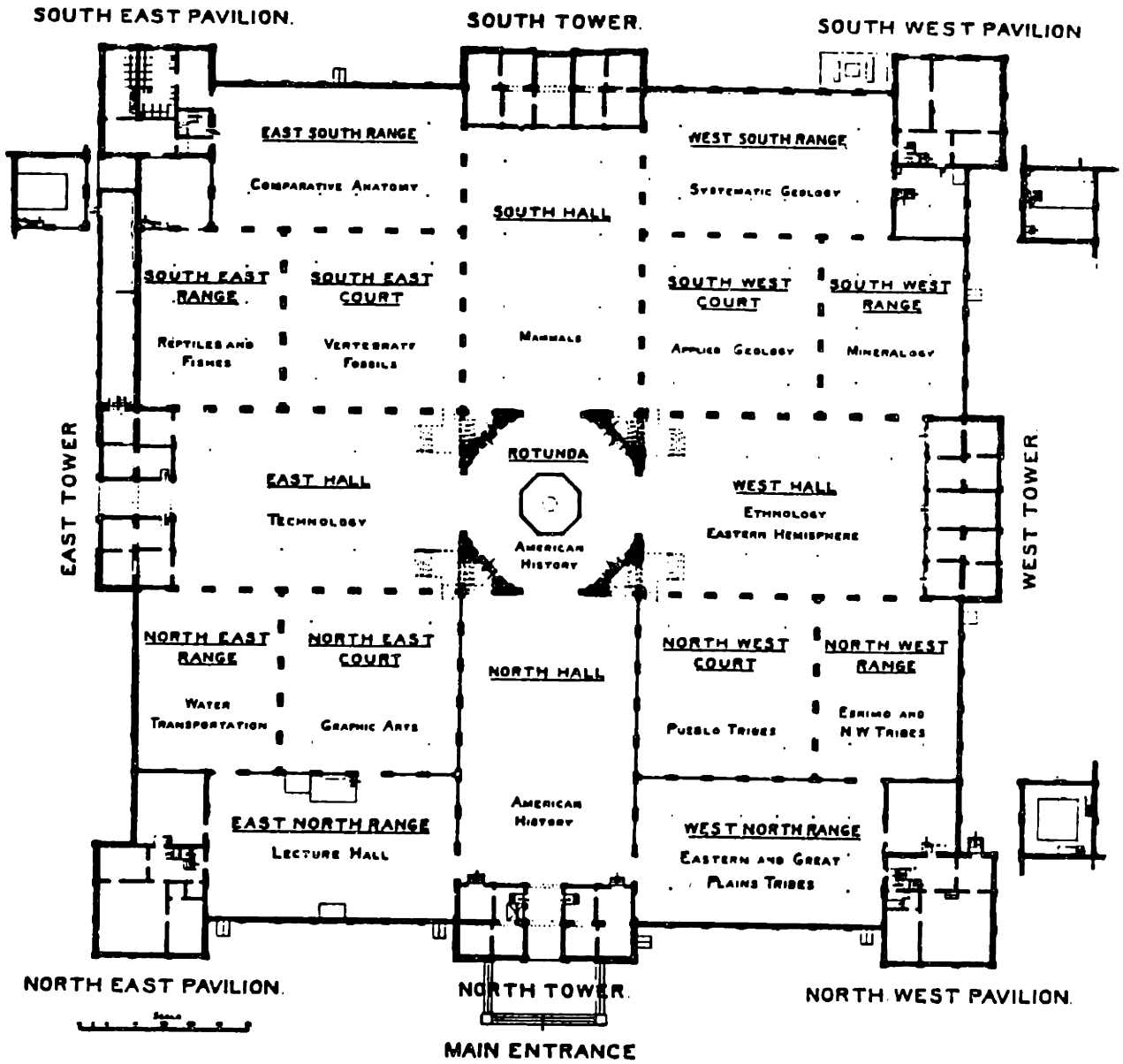


FIGURE 2.

Floor Plan of the National Museum, circa 1903.
[From *USNM Report, 1903.*]



PLAN OF MAIN FLOOR, NATIONAL MUSEUM BUILDING.

CHAPTER 7

"Culture Brokers": Engineers, Inventors, and Museums

Several themes emerge in this study of technologists and museums in the late nineteenth century and of how technological collections were conceived, internally debated, questioned, and sometimes resolved within the institution developing the collections. The parties involved include the museum administration and the cultural elite, as well as the engineers and technologists. In the preceding chapters, however, a third group also loomed important: namely, a group outside the museum community, in the form of the public who would constitute the primary audience.

The development of technology collections in late nineteenth-century American museums constitutes a story of negotiation between engineers and inventors and the cultural gatekeepers in charge of the museums. Professionalizing engineers seeking social status and historical recognition involved themselves in the cultural world. However, their world of dynamic machines and rapidly changing ideas did not fit well with established traditions in the museum world. In addition, pressure from "outside" groups–particularly the public–tried to force the fit. In between the museum authorities and these outside groups, curators such as J. Elfreth Watkins, George C. Maynard, and Joseph G. Pangborn played the role of "culture brokers" for engineering and technology. Key issues in the negotiation included the relationship between elite and popular culture, the professionalization process of engineers and their need for social status and cultural recognition, the place of technology in nineteenth-century lives and hierarchies, and the nature of the culture represented–namely technology.

Culture

Culture, in the context of this discussion, refers to a set of shared values and knowledge for a particular group.[1] This includes behavior patterns, arts, beliefs, and institutions characteristic

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[1]Scholarship on culture is wide-ranging and voluminous. For some general discussions of culture and representing culture, see Richard Kurin, *Reflections of A Culture Broker, A View from the Smithsonian* (Washington, DC: Smithsonian Institution Press, 1997); Lawrence W. Levine, *Highbrow/Lowbrow: The*

of that group. Several groups, and thus several cultures, played important roles in the negotiations analyzed in this work. The American societal elite formed an elite culture focused on wealth and education, represented by the industrialists, the European art collectors and the intellectuals, among others. Art and science fit well with the culture of the American elite. American popular culture more closely characterized working-class groups and some middle class groups. In the nineteenth-century, America also had a shared culture, although it diminished as the century proceeded.[2]

In the case of technology collections in the late nineteenth century, "popular culture" proved the most important. According to Bennett, Mercer and Woollacott, popular culture embodies an "area of negotiation" where "dominant, subordinate and oppositional cultural and ideological values and elements are 'mixed' in different permutations."[3] Ideologies produce cultural categories. Society rather than nature established the different levels.[4] In the case of this study, the dominant culture comprised that of the social and scientific elite, while the subordinate comprised that of engineers, mechanics, laborers, and attendees at world's fairs.

Culture, whether popular or elite, involves negotiation; representations of cultures, their constituent groups and their institutions do not just occur. As anthropologist Richard Kurin indicates, those representations "are mediated, negotiated, and brokered through often complex processes with myriad challenges and constraints imposed by those involved, all of whom have their own interests and concerns."[5] After the mediation, negotiation, and brokering, groups make specific decisions regarding the representation of their own culture or of the culture they try to present. The decisions depend on available resources, the relative power of each group involved, and outside pressure–such as the public or the press. In the case of this study, the outside public pressure played a large role, as did the lack of overall resources for the Smithsonian and the uneven positions of science and technology in the museum pecking order.

Emergence of Cultural Hierarchy in America (Cambridge, MA: Harvard University Press, 1988); Peter Dobkin Hall, *The Organization of American Culture, 1700-1900* (New York, NY: New York University Press, 1982).

[2]See Levine, *Highbrow/Lowbrow.*

[3]Tony Bennett, Colin Mercer and Janet Woollacott, eds., *Popular Culture and Social Relations* (Philadelphia, PA: Open University Press, 1986), xvi.

[4]See Levine, *Highbrow/Lowbrow,* 7-8.

[5] Kurin, *Reflections of A Culture Broker,* 13.

The large cultural institutions and the persons behind them often played major roles in cultural negotiations. Many American cultural institutions originated in the last half of the nineteenth century, including universities, libraries, and many of the large museums. In the first half of the nineteenth century, American culture appeared less hierarchically organized and less rigid than later. In the last half of the nineteenth century, however, a shared public culture began to fragment. The meaning of culture itself solidified and became rigid. Once the American cultural elite had separated itself from the masses and established elite cultural institutions, it gained supporters. Those who wanted to establish their own cultural legitimacy used the traditional cultural avenues to prove they deserved to be there. A cultural gulf grew.[6] Historian Alan Trachtenberg indicates that, "in a mere decade [the 1870s], an entire apparatus appeared, an infrastructure which monumentalized the presence of culture, of high art and learning, within the society." However, this "culture" often had an undemocratic flavor. The urban elite and "high society" ladies built and ran many of these institutions. They focused on classic European art works and an exclusive, wealthy audience. European art collections meant wealth, and wealth meant a natural power to dominate and lead society and culture.[7]

The work of elite social groups created two separate realms. High culture–when defined as art, manners, and affected speech styles–contrasted with the crudeness, haphazardness, and rough-and-ready style of everyday life. The culture of the mechanical arts, by contrast, fit more closely with the world of everyday life. Common people easily identified with it. Even when technical schools such as the Massachusetts Institute of Technology rose to prominence after 1870, the cultural elite did not consider them as prestigious as their liberal arts counterparts. Thus, while engineers, inventor-citizens, and technologists wielded authority in certain areas, culture–and

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[6]On the concept of a shared public culture and its eventual fragmentation and hierarchization, see Levine, *Highbrow/Lowbrow*, 9, 167-176.

[7]For a discussion of the rise of large cultural institutions in the nineteenth century, see Alan Trachtenberg, *The Incorporation of America, Culture and Society in the Gilded Age* (New York, NY: Hill and Wang, 1982), and Lawrence W. Levine, *Highbrow/Lowbrow: The Emergence of Cultural Hierarchy in America* (Cambridge, MA: Harvard University Press, 1988). According to museum historian Joel J. Orosz, a group of museums with a more democratic flavor also existed. [Joel J. Orosz, *Curators and Culture: The Museum Movement in America, 1740-1870* (Tuscaloosa, AL: University of Alabama Press, 1990), ix.] However, elites did not consider these institutions of public spectacle on the same level or of the same type as their museums. Thus, professional engineers, seeking to gain social status, were interested in the elite institutions.

museums in particular–remained a contested area.[8] When technologists did wield influence in cultural arenas, they presented themselves as engineers rather than as mechanics. Mechanics equated with vulgarity and social inferiority. Engineers, by contrast, crafted a public role that included scientific training and a university education, thus bringing themselves into the middle class and closer to the established social elites.[9] Once mechanics became engineers, they supposedly could more readily shift themselves, and their concerns, from one cultural realm to the other.

Nonetheless, while engineers may have wanted to be a part of the elite cultural realm, their work and their machines continued to fit more into the realm of popular culture, exemplified by the numerous international expositions of the era. As discussed in Chapters 2 and 5 above, technology, machines, and inventors pervaded the world's fair settings, which in turn celebrated and revered them. This world of international expositions differed from the elite cultural world. In fact, to America's cultural elite, such "popular culture" not only seemed rather crude and unsophisticated but also smacked of foreign influence.[10]

The 1893 Columbian Exposition symbolized the cultural gulf and diverse cultural realms in its physical layout. The main area of the Exposition–the "White City"–consisted of classical white plaster buildings and monuments that reflected the traditions of the European art in museums. Next to the White City lay the Midway Plaisance, a sideshow of popular entertainment, sound, wild color, and exotic exhibits from all around the world. These two areas exemplified the two cultural realms. In between stood the Transportation Building–with architectural and spatial ties to the White City but a colorfully painted exterior that reflected the Midway. It symbolized the effort of technologists to achieve social status as well as their natural ties to the public, which equally

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[8]For further discussions of the distinctions between the two realms see, Trachtenberg, *The Incorporation of America*, 145; Peter Dobkin Hall, *The Organization of American Culture*, 251-2; and Lawrence W. Levine, *Highbrow/Lowbrow*, 167-176.

[9]See Leo Marx, "Technology: The Emergence of a Hazardous Concept," *Social Research* 64 (Fall 1997): 977-78.

[10]See Trachtenberg, *The Incorporation of America*, 161, and Lawrence W. Levine, *Highbrow/Lowbrow*, 208-213.

enjoyed the magnificent locomotives in the Transportation building and the Ferris Wheel and other exhibits on the Midway.

The third group in the negotiation, the public, sometimes fit into both cultural worlds. The general public included the workers and others as a potential audience for the new collections. This public had made up the bulk of the attendance at world's fairs. Congress also participated in the negotiations. In the 1880s, however, the U. S. Senate was called the "Millionaire's Club" and consisted primarily of railroad, coal, iron, cotton and insurance executives.[11] As seen above, the railroad executives in particular proved helpful to the development of technological collections. As wealthy men, railroad and other industrial executives exercised some influence within the elite cultural world. However, the public also exercised influence because their attendance mattered to museums and because an important museological debate at the time centered on public attendance.

As a cultural institution, did a museum primarily pursue research or display? And, if display, then display of what and to whom? Conflicting demands for public education on the one hand and professional research on the other existed in American museums in the mid-nineteenth century. A "cultural imperative" for popular education existed, but newly professionalized scientists jealously guarded institutions that they claimed for themselves and their research. Museum historian Joel J. Orosz argues that "by 1870 the two claims had synthesized into a rough parity," which he called the "American Compromise."[12] Yet, as we have seen, such conflicting demands continued to pervade the negotiations surrounding the development of technology collections in museums in the 1880s and 1890s.

Nineteenth-century American museology contained two strains, which some scholars have designated "professional" and "democratic."[13] Each strain related directly to what type of cultural institution critics believed a museum should be–elite or popular. Joseph Henry sketched out the guidelines of "professional criticism" as early as the 1840s, but George Brown Goode made the

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[11]Trachtenberg, *The Incorporation of America,* 165.

[12]Orosz, *Curators and Culture,* ix.

[13]See the work of Orosz, *Curators and Culture,* particularly pages 238-246. See also Michael M. Ames, *Cannibal Tours and Glass Boxes: The Anthropology of Museums* (Vancouver, Canada: University of British Columbia Press, 1992), particularly pages 15-37.

first full statement of it in a paper presented in 1888 to the American Historical Association, "Museum-History and Museums of History."[14] Professional criticism held that American museums in the nineteenth century had focused too much on display of the spectacular or the bizarre–the "sideshow." These displays had little or no scientific value, and thus should be abandoned. Democratic criticism held that American museums had been based on undemocratic, elitist traditions from Europe. The public had no say in museum origination and derived no direct benefit from them. Contrary to American tradition, museums were of the elite, by the elite, and for the elite. That had to change for the institutions to be truly American in character.

George Brown Goode saw both strains and an inherent conflict between the two. Goode, as a scientist and an official at Joseph Henry's Smithsonian, advocated the Smithsonian as a center of scientific research. Nonetheless, Goode's realistic side wanted exhibits that would bring in large audiences and spread the knowledge which science developed–along the lines of the popular world's fairs. Thus, Goode's attitude appeared somewhat ambivalent or conflictual. As shown above in Chapter 3, this ambivalence both helped and hurt the technological collections. Goode created the Department of Industrial Arts, in which technology found its first National Museum home. Although the Department died, the technology collections remained. The conflict between professional and popular missions also remained and continued unabated at the USNM and later at the Field Museum. As a national institution in a democratic state, the National Museum displayed collections for the public. As an important cultural institution, by contrast, the museum tried not pander to sensationalistic popular culture and demands. Yet, the technological collections attracted the public and belonged to that popular culture. The culture that the technological collections represented also belonged to technologists, particularly engineers. Yet, in a larger sense, the culture also concerned all of America, as a technological and mechanical nation.

This culture had to be brokered among competing groups, including museum professionals, technologists, the public, and cultural elites. Here engineers played a key role. According to Richard Kurin, "the role of the culture broker generally begins not in an institution

[14]See Goode, "Museum-History and Museums of History," presented at the American Historical Association meetings, Washington City, December 26-28, 1888, reprinted in *USNM Report, 1897*, 65-81.

but out in the field, with the people who are being represented."[15] Watkins and Maynard began not in the museum, but out in the field as practicing engineers with a group in the midst of a process of professionalization that, in turn, proved essential to their work in the museums.

Professionalization of Engineers

The late nineteenth century witnessed the professionalization of engineers in the United States. Scholars, such as Monte Calvert and Malcolm S. Gregory, have stated that professional engineering activity was in full-swing in the late 1860s and early 1870s. By the end of the nineteenth century, engineering had fully developed as a profession.[16] Engineers could be found in virtually every industry–railroad transportation, machine tools, steel making, and pumping. In addition, over eighty engineering colleges existed in the United States by 1880. In 1882, the first central power plant for distributing electricity, Thomas Edison's Pearl Street Station, opened in New York City. The latter part of the nineteenth century also saw increased specialization within engineering. In 1888, J. Elfreth Watkins wrote: "Engineering has been so intimately connected with and interwoven in the development of the art of transportation, especially of late years, that the problems presenting themselves to the projectors of railways and the constructors of steamships have evolved several distinct branches of engineering especially devoted to their solution."[17]

The process of professionalization involved several steps for engineers. Engineers established a systematic technical knowledge with theory and practice. They recognized a need for specialized training. Recognition of the need for socialization and control, such as licensing,

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[15]Richard Kurin, *Reflections of A Culture Broker*, 1.

[16]See Monte Calvert, *The Mechanical Engineer in America, 1830-1910, Professional Cultures in Conflict* (Baltimore, MD: Johns Hopkins University Press, 1967), 109, and Malcolm S. Gregory, *History and Development of Engineering* (London, UK: Longman, 1971), 7. See also Daniel H. Calhoun, *The American Civil Engineer; Origins and Conflict* (Cambridge, MA: MIT Press, 1960); Raymond Merritt, *Engineering in American Society, 1850-1875* (Lexington, KY: University Press of Kentucky, 1969); Bruce Sinclair, *A Centennial History of the American Society of Mechanical Engineers, 1880-1980* (Toronto, ON: University of Toronto Press, 1980); and Michal McMahon, *The Making of a Profession: A Century of Electrical Engineering in America* (New York, NY: Institute of Electrical and Electronics Engineers, 1984).

[17]J. Elfreth Watkins, "Report on the Section of Transportation and Engineering," in *USNM Report, 1888*, 107. For the history of the ASCE and other societies see Daniel H. Calhoun, *The American Civil Engineer; Origins and Conflict* (Cambridge, MA: Massachusetts Institute of Technology, 1960); Monte Calvert, *The Mechanical Engineer in America;* Edwin T. Layton, *Revolt of the Engineers* (Baltimore, MD: Johns Hopkins University Press, 1986); and Raymond H. Merritt, *Engineering in American Society, 1850-1875* (Lexington, KY: University Press of Kentucky, 1969).

followed. Engineers also developed a sense of responsibility to society. International knowledge ranked above and limited the self-interest of the engineers. Finally, self-consciousness about social status and societal roles developed among a substantial portion of the engineers and their established professional associations.[18]

Institutional professionalization for engineers occurred with this last step. These institutions included educational ones and professional ones. Both types of institutions wielded influence on the profession's temperament and constitution. The institutions socialized engineers and determined their roles at different stages of their career. Both educational institutions and professional associations worked with Watkins and Maynard in their museum efforts. For example, the AIEE and the ASCE, as well as Stevens Institute of Technology, donated numerous items to the USNM technological collections. As shown above in Chapter 4, several organizations also wrote petitions to the museum administration and to the U. S. Congress supporting Watkins' efforts.

The institutions and associations also worked with Watkins and Maynard in the museum world to address some issues of professionalization–such as self-consciousness about social status and historical place. Engineers began to have a sense of their important role in history, so they espoused history. "The evolution of civilization was based on inventions, such as fire, pottery, the manufacture of iron, and the production of power," maintained ASCE president George S. Morison in an 1895 speech. "Each of these developments determined an epoch in human history."[19] The engineer deserved his place as an historical figure.[20]

Engineers also tried to provide leadership for the transformation of American society and culture; however, as seen above, this leadership did not translate well into the cultural world of museums. Engineers tried to move from their place as industrial and engineering consultants to a place as cultural consultants. They joined churches, helped start libraries and schools, and ran for

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[18]For a detailed examination of the professionalization process of engineers, see Calvert, *The Mechanical Engineer in America*, xv-xvi.

[19]Layton, *Revolt of the Engineers*, 58.

[20]For further discussion regarding engineers and their need for social status, see Layton, *Revolt of the Engineer*. Layton went so far as to call the engineers' concern over social status "morbid" (61). See also Raymond H. Merritt, *Engineering in American Society*.

public office. This tendency would reach its peak in the early twentieth century with the engineers among the Progressive Movement.[21] In the nineteenth century, however, engineers remained subordinate in elite cultural realms. For example, Joseph Henry, the Smithsonian's first Secretary, had spent part of his career as a surveyor and engineer.[22] He moved upward in his career from there to science, and his time as an engineer did not appear to raise his view of applied science, as shown above in Chapter 1. The professionalization process did not give engineers status in the museum world. In that world, engineers remained subordinate, particularly to scientists. They did not become part of the elite in the way that scientists did. At the same time as the importance of engineering in society grew, as exemplified by developments in scientific management, no comparative growth existed in elite cultural settings.

The American technological community developed differently than museum and elite cultural communities. While American culture developed a hierarchy, the community of technologists in America remained flexible. The professional associations formed along engineering specialties–such as civil, mechanical, and electrical. Their organizations did not fall easily into socially hierarchical tiers. Many debates occurred over what determined levels of membership. In Europe, the school that an engineer attended would have mattered greatly. In many American engineering societies, they advocated full membership only for those actively involved in engineering work–regardless of social and cultural credentials such as university training. Thus, the memberships of the societies in the nineteenth century tended toward heterogeneity with regard to social and economic origins. In the early societies, the membership tended to come from the eastern United States. However, as the US expanded west, so did the engineers, and professional engineering membership gained regional diversity.[23]

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[21]See Layton, *Revolt of the Engineers*.

[22]For information on Joseph Henry and his early career, see Chapter 1 above and Albert E. Moyer, *Joseph Henry, The Rise of an American Scientist* (Washington, DC: Smithsonian Institution Press, 1997), 34-40.

[23]For a discussion of the development of cultural and social hierarchies in nineteenth-century America, see Lawrence W. Levine, *Highbrow/Lowbrow*. For discussions of the nature of the technology community and some attempts to create hierarchy, see Eda Kranakis, *Constructing a Bridge, An Exploration of Engineering Culture, Design, and Research in Nineteenth-Century France and America* (Cambridge, MA: MIT Press, 1997), Monte Calvert, *The Mechanical Engineer in America*, and Daniel H. Calhoun, *The American Civil Engineer*.

Part of the reason for the lack of success for technologists in elite cultural settings lay in the fact that the professionalization of engineering came on the heels of the professionalization of science and often took cues from the scientific community.[24] Science had professionalized before the founding of the Smithsonian and, thus, before engineering. In the mid-nineteenth century, "natural philosophers" had become "scientists." Full-time professionals replaced amateurs. In addition, there had been institutional professionalization with the formation of the Academy of Natural Sciences of Philadelphia (1812), the Western Academy of Natural Sciences (1810), the US Exploring Expedition (1838), the Association of American Geologists and Naturalists (1840), the National Institute for the Promotion of Science (1840), and the American Association for the Advancement of Science (1848).[25] Thus, scientists in the mid-nineteenth century had secured a position from which they could fight for what they wanted at the founding of the Smithsonian.

Nonetheless, the scientists did not win a complete victory. The new, presumably elite, cadre of professional scientists encountered a basic problem in the egalitarian ideals of American society. While scientists leaned toward elite specialization and specialized knowledge, American society moved toward popularization and democratization. Demands for public schools as well as popular education in museums arose. Scientists did not oppose the diffusion of knowledge, but they, like Henry, worried over the efforts at diffusion overtaking and diluting resources for scientific research. In the second half of the nineteenth century, the professional scientists in the museum world eventually backed down to avoid charges of monopoly and appearances of "godless" tendencies. This retreat allowed for the rise of popular education in museums.[26] It also created a place for the newly professionalizing engineers. However, in the engineers' process of

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[24]For a discussion of the historical relationship between science and technology communities, see Edwin T. Layton, Jr., "Technology as Knowledge," *Technology and Culture* 15 (1974): 31-41; Layton, "Mirror-Image Twins," *Technology and Culture* 18 (1977): 562-80; and Layton, "Through the Looking Glass, or News from Lake Mirror Image," *Technology and Culture* 28 (1987): 594-607.

[25]For discussions of the professionalization of science, see Alexandra Oleson and Sanborn C. Brown, eds., *The Pursuit of Knowledge in the Early American Republic: America Scientific and learned Societies from Colonial Times to the Civil War* (Baltimore, MD: Johns Hopkins University Press, 1976), and Alexandra Oleson and John Voss, eds., *The Organization of Knowledge in Modern America, 1860-1920* (Baltimore, MD: The Johns Hopkins Press, 1979).

[26]For a more detailed discussion of the impact of scientific professionalization on museum development, see Orosz, *Curators and Culture,* 181-82.

professionalization, they lost part of what had made them a unique group. They changed from being mechanics and tinkerers to being "applied scientists" since science, techniques, and practical craftsmanship combined to produce new developments in engineering in the nineteenth century. While this association with science brought the engineers some of the cachet that scientists had, it also made it more difficult to distinguish the engineering profession as important in itself. This relationship between science and engineering proved problematic for technologists.

Technology and Science

Scientists played a key role in the negotiations for the brokering of the culture of engineering and technology. Scientists had previously aided technology and industry, but much of their research and investigations had been irrelevant to industrial needs. In the nineteenth century, this relationship between science and industry changed with the growth of "applied science."[27] Engineering was linked to science, as applied science, and, in the cultural world, science was linked to the elites. Therefore, engineering sometimes enjoyed the benefits of high societal views of science. Yet this link also subordinated engineering to science. Some recent historians of technology have argued that debate over distinctions between science and technology proves fruitless.[28] Nonetheless, this difference held importance for the groups negotiating over mechanical and technological collections in the late nineteenth century. Their views and beliefs mattered in the brokering process.

In 1872, the Smithsonian published an article on the "Scientific Education of Mechanics and Artisans" that shed light on the contemporary views of the relationship between technology and science. Andrew P. Peabody (1811-1893), a noted theologian and preacher at Harvard University, had presented the paper at the Annual Commencement of the Worcester Free Institute

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[27]For an extended discussion of this change, see Everett Mendelsohn, "The Context of Nineteenth-Century Science," in *The Golden Age of Science,* ed. Bessie Zuban Jones, xiii-xxviii (New York, NY: Simon & Schuster, 1966), xxii.

[28]See particularly John Staudenmaier, "Recent Trends in the History of Technology," *American Historical Review* 95 (1990): 715-725; Staudenmaier, "What SHOT Hath Wrought and What SHOT Hath Not: Reflections on Twenty-five Years of the History of Technology," *Technology and Culture* 25 (1984): 707-730; and Staudenmaier, *Technology's Storytellers, Reweaving the Human Fabric* (Cambridge, MA: MIT Press, 1985).

of Industrial Science. As the titled indicates, the piece focused on "the worth of an extended education to mechanics and artisans." Peabody advanced two possible views in his advice for the education of mechanics. Both views held technology subordinate to science and the social elites. One maintained that mechanics and engineers needed to be raised up to the level of science. The other held that engineering and mechanical education needed to be improved. Engineers needed to be educated so that they could join "capital" in the late-nineteenth-century conflict between capital and labor.[29]

According to Peabody, engineers found themselves placed squarely in the middle of an important issue of the last quarter of the nineteenth century: class struggle. "Every skilled laborer belongs to both parties [capital and labor], and in fighting against capital he is at war with himself," Peabody argued. "If he begins life poor, his interest may, indeed, then seem to be on the side of labor," he continued, "but with every year's savings it is more and more for his interest that capital should yield a remunerative income, and the very measures which, if successful, would impoverish the millionaire, would render his modest surplus earning unproductive and their investment insecure."[30] Many late-nineteenth-century engineers and inventor-citizens landed even more squarely in the middle of the debate since they tended to be entrepreneur-inventors or entrepreneur-engineers.[31]

In the ongoing struggle between capital and labor, the elites on the side of capital often attempted to co-opt the new profession of engineering to their side. But in doing so, they defined technology as applied science. The newly developed technical schools of the time trained men to lessen production's labor expense, to apply science in new ways to the "useful arts," and to improve society as a whole through technological improvements. Thus, they trained engineers to serve the side of capital, which naturally benefited society.

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[29]Professor Andrew P. Peabody, "The Scientific Education of Mechanics and Artisans," in *Annual Report, Smithsonian Institution, 1872*, 185-195.

[30]Peabody, "The Scientific Education of Mechanics and Artisans," 189.

[31]For discussions of engineers and inventors as entrepreneurs and partakers in the class struggle see Monte Calvert, *The Mechanical Engineer in American*, 225-43; Edwin T. Layton, *Revolt of the Engineers*, 1-24; Thomas P. Hughes, *American Genesis: A Century of Invention and Technological Enthusiasm 1870-1970* (New York, NY: Viking, 1989); and Ruth Schwartz Cowan, *A Social History of American Technology* (New York, NY: Oxford University Press, 1997), 119-148.

While scientists and industrialists associated with the cultural elites of the era, their views of technology and technologists differed. The industrial elites often maintained that discovery and application constituted two different arenas, but the businessmen and entrepreneurs among them often felt that the technology side held just as much importance–particularly in its commercial value. American society needed both the "inventor" and the "discoverer." The ideal combined the two groups, rather than valuing one over the other. For example, Eli Whitney presented a rare example where the two combined. Whitney graduated from Yale and combined a literary and scientific education with mechanical aptitude.[32]

As seen in Chapter 1, Joseph Henry and others had viewed the arenas of elite, pure science and of manual mechanics and technology as two very different enterprises. With the professionalization of engineering came the belief in raising the field of technology to the level of science. Nonetheless, some scientists considered technology as different from science but not as completely inferior. Prominent British scientist T. H. Huxley (1825-1895) wrote in 1887: "It is a curious speculation to think what would have become of modern physical science if glass and alcohol had not been easily obtainable; and if the gradual perfection of mechanical skill for industrial ends had not enabled investigators to obtain, at comparatively little cost, microscopes, telescopes, and all the exquisitely delicate apparatus for determining weight and measure and for estimating the lapse of time with exactness, which they now command." For Huxley, science owed as much to technology as technology owed to science. In fact, Huxley saw certain similarities between science and technology. He also appeared to argue for a combination of science and technology. But even he continued to believe that "the great steps in its [physical science's] progress have been made, are made, and will be made, by men who seek knowledge simply because they crave it." Science for the sake of science only was acceptable and necessary. Technology, such as printing, gunpowder, steam transport, the telephone, and electric telegraphy, represented the "gifts of science."[33]

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[32]Peabody, "The Scientific Education of Mechanics and Artisans," 191.

[33]T. H. Huxley, "Advance of Science in the Last Half Century," in *Annual Report, Smithsonian Institution, 1887*, 63, 88. Thomas H. Huxley was a prominent English biologist who was known for his success in popularizing Darwinism.

In the popular or public realm, the view of engineers ranked much higher than in the scientific and cultural realm. Great popular enthusiasm existed for engineering and mechanical technology. Popular writers often eulogized engineers. For example, William D. Howells, upon visiting the great Centennial exhibition in 1876, wrote:

> In the midst of this ineffably strong mechanism [the giant Corliss engine] is a chair where the engineer sits reading his newspaper, as in a peaceful bower. Now and then he lays down his paper and clambers up one of the stairways that cover the framework, and touches some irritated spot on the giant's body with a drop of oil, and goes down again and takes up his newspaper; he is like some potent enchanter.[34]

Such writings placed pressure on the elites to pay greater attention to technology as a vital social and cultural force.

Joseph G. Pangborn, when working with the Field Columbian Museum, blamed his failure to build the railroad transportation collection on the dichotomy between pure and applied science. Technology proved practical; pure scientific research at museums did not. The public appreciated technology–particularly the railway; the museum world did not. Pangborn noted that, as far as American museums were concerned, "this country follows European examples to an extent largely bordering upon duplications." But America itself appeared different in terms of its technology. "In what may be termed pure science, we follow, we do not lead," Pangborn asserted, "but in applied science, the reverse is rapidly becoming the rule."[35] However, pure scientists dominated the museum world and this hurt technology, even when defined as applied science. Pangborn wrote critically:

> Men whose lives have been on lines within the field of pure science intuitively incline in such direction; and as the operation thus far of the forces concentrated upon the Columbian Museum has demonstrated the influence of those contemplating the possibilities from only the one standpoint, the natural sequence is the impression that *applied science is not to be considered* or if so, simply upon the basis of *toleration*, as illustrated in the South Kensington Museum of London, where several of the most precious mechanical relics in existence are relegated to an old tumble down wooden structure, – forced out of the larger, the more modern and substantial buildings, to make room for the anthropological etc., etc. Or as in the Conservatoire des Arts et Metiers of Paris, where the Cugnot, the first construction

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[34] William D. Howells, "A Sennight of the Centennial," *Atlantic Monthly* (July 1876): 96.

[35] Pangborn to Williard A. Smith, Chief, Department of Transportation Exhibits, World's Columbian Exposition, November 24, 1893, in Railroad Memorabilia Collection, Correspondence, 1893-1979, 1893 Folder, FMNHAL.

> for steam propulsion on land in the history of the world, is practically hidden away in a dark corner of an adjoining building, built early in the last century.[36]

Pangborn saw the answer for the engineers in building an institution new and separate from the old established museum community, thus avoiding the prejudices. "There is not in the world a great mechanical museum, and there will not be until one is founded entirely divorced from the influence and control of those whose inspiration is pure science," he wrote. Naturally, this new institution should reside in America, "the foremost mechanical nation of the world."[37]

A complex view of technology and technologists existed in the late nineteenth century. Technology differed from the elite social and cultural realms. Some members of that elite attempted to lift technology up to their level and to co-opt it and the technologists. A few members of the elite actually supported technology. This complex view of technology reflected the conflict between exclusive centers and resources for the elite and the responsibility toward the public in a democratic society. The practical and educational nature of machines and technology conflicted with the emphasis that high culture and science placed on display and discovery for its own sake.

The Transitory Nature of Technology

As indicated in Chapter 2, the nature of technology encompassed the ideas of movement, change, and transience; these ideas conflicted with the static world of museums. Whereas the world's fairs celebrated a constantly advancing technological edge, the social and cultural "establishment" often built and ran the museums. According to Alan Trachtenberg, "museums established as a physical fact the notion that culture filtered downward from a distant past, from overseas, from the sacred founts of wealth and private power."[38] This notion differed dramatically from the themes of dynamism and progress that American technology and mechanics embodied.

The American technological community proved dynamic and fluid, just as the machines which they built and with which they dealt. This fluidity reflected a characteristic of American society that differentiated and set it apart from Europe. Museums tended to identify with traditional

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[36]Pangborn to Williard A. Smith, November 24, 1893, FMNHAL.
[37]Pangborn to Williard A. Smith, November 24, 1893, FMNHAL.
[38]Trachtenberg, *The Incorporation of America,* 144-45.

European society and culture. The culture of technology and engineering, by contrast, had a very different character and had to be brokered differently.

Nineteenth-century engineers in the United States reflected the transitory nature of the technology they created. Engineering functioned as a "mobile profession," and engineers proceeded from one large project to the next, often in different geographical regions. The results of those projects often appeared hastily built and inelegant.[39] Upon visiting the United States in 1837, a British engineer named David Steven noted that:

> At the first view, one is struck by the temporary and apparently unfinished state of many of the American works, and is very apt, before inquiring into the subject, to impute to want of ability what turns out, on investigation, to be a judicious and ingenious arrangement to suit the circumstances of a new country, of which the climate is severe – a country where stone is scarce and wood is plentiful, and where manual labor is very expensive. It is vain to look to the American works for the finish that characterizes those of France, or the stability for which those of Britain are famed. Undressed slopes of cutting and embankments, roughly built rubble arches, stone parapet-walls coped with timber, and canal locks wholly constructed of that material, every where offend the eye accustomed to European workmanship. But it must not be supposed that this arises from want of knowledge of the principles of engineering, or of the will to do them justice in the execution. The use of wood, for example, which may be considered by many as wholly inapplicable to the construction of canal-locks, where it must not only encounter the tear and wear occasioned by lockage of vessels, but must be subject to the destructive consequences of alternate immersion in water and exposure to the atmosphere, is yet the result of deliberate judgment. The Americans have, in many cases, been induced to the material of the country, ill adapted thou_h it may be in some respects to the purposes to which it is applied, in order to meet the wants of a rising community, be speedily and perhaps superficially completing a work of importance, which would be otherwise delayed, from a want of the means to execute it in a more substantial manner, and although the works are wanting in finish, and even in solidity, they do not fail for many years to serve the purposes for which they were constructed, as efficiently as works of a more lasting description.[40]

This "temporary" nature of technology, in Pangborn's view, made it something difficult to fit with the nature of the traditional "museum." Movement exemplified technology in the Baltimore and Ohio exhibition he developed for the 1893 world's fair. He wrote: "Not one [machine] in the entire collection but what can by the application of power, electric or other, be made to show the mechanism in actual operation." Moving machines increased the educational value of the displays.

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[39]For a discussion of the characteristic mobility and movement in engineers and engineering structures, see David Nye, *American Technological Sublime* (Cambridge, MA: MIT Press, 1994).

[40]David Steven, *The Civil Engineer of North America* (London, UK: J. Weale, 1838), 192-93, quoted in John Rae and Rudi Volti, *The Engineer in History* (New York, NY: Peter Lang, 1993), 149-150.

Pangborn emphasized that "in the actual or its full-sized working reproduction, there is a comprehension far exceeding that gained from small models, and the average man following a line of originals or replicas, each in turn illustrating development, secures an understanding which he would scarcely encompass in a month through other means."[41]

Pangborn's concerns also point to another aspect of nineteenth-century technology in the United States: namely, its size. The key symbols of technology for the public audience loomed larger than the other artifacts in the museums of that era. From steam locomotives to giant steam engines, such as the Corliss engine at the Philadelphia fair, these mechanical machines affected the very size and layout of any museum that attempted to collect them. The transient and changing nature of the technology made its sheer size even more of a problem. For example, once good technology collections had been assembled at museums such as the National Museum and the Field Museum, they proved to be in demand for the numerous world's fairs and expositions. However, sending such collections became a monumental undertaking, often including the removal of walls and the laying of tracks.[42]

Thus, the nature of the culture being brokered included a diverse group of mechanics, inventor-citizens, professionalized engineers, and large changing machines. The general public and the so-called lower classes related more to the culture of technology than did the social and cultural elites. Those elites often viewed the culture of technology as subordinate to science and only an application of science; but others viewed it as a quintessential expansion of American culture and growth. In the late nineteenth and early twentieth century, a sense of progress, movement, change, and an often-grandiose size, defined technology. Thus, how does a group of engineers enable that culture to enter into the elite, static, scientific world of the Smithsonian and other major museums? They broker it.

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[41]Pangborn to Williard A. Smith, Chief, Department of Transportation Exhibits, World's Columbian Exposition, November 24, 1893, in Railroad Memorabilia Collection, Correspondence, 1893-1979, 1893 Folder, FMNHAL.

[42]For a description of the difficulties of such collections, see correspondence regarding the attempt to take the railway transportation collection of the Field Columbian Museum to the St. Louis World's Fair in 1904, in Railroad Memorabilia Collection, Correspondence, 1893-1979, 1903 Folder, 1904 Folder, FMNHAL.

The Brokering of the Culture of Technologists

J. Elfreth Watkins, George C. Maynard, and Joseph G. Pangborn brokered the culture of engineering, mechanics, and technology between the world of the technologists, the world of museums, the cultural elites, and the growing public audience. Thus, a variety of interests took part in the negotiations. While the efforts of Watkins, Maynard, and Pangborn may not have been as organized and systematic as professional brokers of the late twentieth century, they encompassed at least amateur culture brokering.[43] They studied the culture to be represented (technology), determined the best way to accomplish an appropriate representation, and brought together the parties involved.

In the case of this study, the parties included the public as audience, the technologists as the represented, and the museum officials as the representer. Watkins, Maynard, and Pangborn mediated between diverse groups that included not only the engineering and transportation industry, but also audiences from the world's fairs as well as those in the museum world fighting for public education. They, as cultural brokers, had to work within the practices of each of the communities involved–such as the institutional and social infrastructure of museums and the practices and beliefs of engineers, mechanics, and other technologists.

All of the brokers involved with the culture of technology at the National Museum and the Field Museum did not necessarily arrive at the same conclusion as to the best way to represent that culture. Nonetheless, some themes carried through much of their work. They equated the development of technology with societal progress. Moreover, inventors, mechanics and engineers played heroic roles in that progress. Technology and technologists played key historic roles, particularly in American history, and deserved a position of respect–equal to science–within the museum community.

In addition, the brokering involved the use of tools, and all the brokers did not utilize the same ones. They used various arguments, insights, knowledge, and techniques for persuasion and amusement. The argument for the preservation of modern technology as something

[43]For a discussion of late-twentieth-century brokering, particularly in cultural realms, see Richard Kurin, *Reflections of a Culture Broker*, 18-22.

quintessentially American pervaded the work of Watkins, Maynard, and Pangborn. Watkins and Maynard also argued that museums should preserve technological artifacts from the steam and railway age because they constituted a natural progression from items already collected by museums–that is, the tools and transportation vehicles from primitive races that belonged in the anthropological and ethnological exhibits. Pangborn, by contrast, argued that museums should preserve these technological artifacts as something important and distinct in and of themselves. They did not constitute a part of anthropology, nor did they consist simply of the products of applied science. All three men used techniques of amusement, largely drawn from world's fair techniques, to attract large audiences. However, Watkins and Maynard attempted to tone down some of the exposition tactics that conflicted with traditional museum practice. Watkins focused on synoptic exhibits–a technique popular at the fairs and prevalent in other USNM exhibits. Pangborn, however, continually pushed for movement and dynamic exhibits–a technique quite foreign to traditional museum exhibits of that era.[44] Watkins and Maynard persuaded through compromise, while Pangborn attempted to persuade through perseverance and grating aggressiveness. In the final analysis, Pangborn pushed for all and received nothing lasting. Watkins, Maynard, and Pangborn all brokered the culture of technology in museum settings, and all three wanted technology to gain its proper place in those settings. Watkins and Maynard succeeded in getting a permanent presence for their technology collections because they tried to work within museum practice. Pangborn argued solely from the standpoint of a railway official and enthusiast. While Watkins and Maynard did not achieve all they hoped for the technology collections, they did succeed in creating a permanent place for them at the Smithsonian. Pangborn, by contrast, procured only a temporary place for technology at the Field Museum and the collection disbursed early in the twentieth century. Thus, different techniques and tools in cultural brokering can achieve different results, even if the basic goals match.

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[44]Pangborn's notion of a technology museum resembles a recent phenomenon often called "science centers." While the American Association of Museums adjusted their definitions in the 1970s to include these institutions, debate continues regarding whether they truly constitute museums. Nonetheless, science centers attract enormous audiences, just as Pangborn, and probably Watkins, would have predicted.

Cultural brokering proves more complex than a simple brokering involving bartering or give-and-take. The brokers do more than simply bring two parties together. Often, the parties have more invested in cultural representations than in financial situations that need to be brokered. The "unit of exchange" in the brokered deal can be quite complex and can appear differently to each of the parties involved. For example, the final "deal" which Watkins made at the USNM (and Maynard and others maintained) appeared differently to the museum officials than to the public audience or the technologists represented. Watkins, in particular, used those different views to make the deal possible. Watkins used ambivalencies and vagueness within the museum setting to broker a place for the technological collections. He compromised and accepted a subordinate place for technology. The vagueness of Smithson's original bequest allowed for the argument of the inclusion of technology as knowledge, if one could argue that technology was knowledge. Watkins also used the views of Joseph Henry and others to find a place for technology in a scientific institution as "applied science." In addition, Watkins allowed technology to be considered part of anthropology to attain the assistance of museum professionals such as George Brown Goode and Otis T. Mason.

Watkins, Maynard, and Pangborn all used public pressure and the popularity of technological and mechanical displays at fairs to negotiate a place for them in museum settings. However, when the museum administrations undercut their institutional foundations, in the form of abolishing the Department of Arts and Industries and the Department of Industrial Arts in 1897, Pangborn adopted different measures than Watkins and Maynard. He began to argue for a separate institution for the transportation collections, separate from the Field Museum and separate from the established museum setting. In the end, the Field Museum lost its mechanical and transportation collections, and Pangborn did not set up any separate railway museum. Watkins, with Maynard's assistance, succeeded in negotiations to keep the technology collections alive and physically present at the National Museum. Before Watkins and Maynard, museums, in their choice of collections, had physically defined culture as filtered down from a distant past, from overseas, and as associated with wealth and social power. After Watkins and Maynard, the physical presence of

the great number of machines, mechanical models, patent models, and other technological objects in the National Museum established as a physical fact the notion that culture also included technology, particularly in the United States. They had brokered a permanent place for technology, even though it remained subordinate to older, more traditional fields of museology.

CHAPTER 8

Conclusion and Epilogue

Pushes from cultural milieus existing outside the nineteenth-century American museum–particularly the professional engineers, their idea of their role in US society and culture, and the public audience–forced the development of technology collections in museums, often over the objections of museum administrators. Such forces aided J. Elfreth Watkins and George C. Maynard in brokering a place for technology collections at the USNM. By the turn of the century, their place was assured, if minor. Such cultural brokering fostered the development of technological collections that otherwise would have been too difficult to collect because of administrative restrictions and the pull of tradition.

Without calls from outside the Smithsonian, and ongoing brokering between the inside and the outside, the USNM would have paid little attention to technology. In the mid-nineteenth century, technology held a place in popular imagination, but not in the halls of science or elite culture. In the Smithsonian's early years, no one represented the culture of invention and technology. Although Joseph Henry had briefly been an engineer, the culture he advocated at the Smithsonian during the 1840s and 1850s embraced science and original research. Henry's views and those of the scientific community in general also argued against the inclusion of museum collections for popular display. Contrary to Henry's position, Spencer Fullerton Baird condoned the development of a national museum collection in the 1860s and 1870s. By the 1870s, Smithsonian officials had hesitatingly accepted popular display and education as objectives for museum collections. However, technology did not form an integral part of the Smithsonian focus or interest. Although technology held a key position in US society and at the international fairs and expositions, the Smithsonian collection continued to focus almost exclusively on science. Nonetheless, the 1876 Centennial Exposition at Philadelphia set the stage for negotiating a place for technological collections at the Smithsonian. Although the Centennial Exposition indirectly affected technological display at the Smithsonian and the USNM, it did not bring many

technological collections into the USNM. Rather, it aided the National Museum in becoming a distinct entity within the Smithsonian Institution and aided the efforts aimed at display for public education. Both of these situations helped open a place for technology to slip in. George Brown Goode pushed industry and technology in the 1880s and 1890s, but primarily as components of anthropology and the development of civilized man. By 1881, Goode and the Smithsonian had created the Department of Arts and Industries and a possible home for the technology collections. He also opened a door to technology and technologists by using the ambiguities of Smithson's will to find a place for technology at the USNM, as "applied science" or a part of anthropology. Groups outside the Smithsonian, with the aid of some engineers brokering their own culture, forced technology through the door that Goode had opened and into a permanent place at the Institution. The roots of the museum's new organization and of the space for the new technological collections that Goode wanted rested in his experience with the 1876 Exposition. From that point until his death in 1896, Goode became the primary force shaping the USNM. He changed museum practice and, in so doing, allowed his views on technology to enter the museum world. Goode envisioned an active rather than a passive museum. This activity allowed some room for the fluid, changing ideas of technology. Under his leadership, some outside forces entered the museum to broker a place for technology, and technological collections developed as a permanent part of the National Museum.

In the 1880s and 1890s, the efforts of engineers, particularly railway engineers, pushed technology as an important part of US culture that museums needed to preserve alongside other cultural and historical objects. J. Elfreth Watkins became the source of their entry into the museum world and began to broker their culture there. From 1884 to 1892, he worked diligently–mediating and negotiating– to build the technological collections at the USNM. He worked at a key period when engineers began to establish a professional identity and eagerly promoted and preserved the history of their work. Watkins' connections to the engineering ranks outside the museum proved essential, but so did his ability as broker. He, and George Maynard after him, used ambivalencies and vagueness within the museum setting to create a place for the technological collections. They

pushed and stretched the boundaries of museum practice but refrained from breaking them. They compromised by accepting a subordinate position for technology. Watkins allowed technology to be considered part of anthropology to get the aid of museum professionals such as George Brown Goode and Otis T. Mason.

Watkins' efforts to transfer the technology and transportation exhibits of two world's fairs to a permanent setting in a museum continued at the Field Columbian Museum. However, the main broker at the Field Museum for the mechanical and transportation collections proved to be Joseph G. Pangborn rather than Watkins. While Watkins returned to the USNM, Pangborn negotiated between the museum world and the railway world. However, he played outside the rules of practice of the institutions with which he dealt, and he failed. Mediators, such as Pangborn, needed to take into account the practices of both sides in the mediation. Watkins, Maynard and Pangborn had to work within the practices of the museum world as well as those of the technological and engineering communities. Pangborn had difficulties with both, and the traditional areas of museum expertise and concern–such as ethnology and anthropology–prevailed over the new areas of technology and transportation at the Field Museum.

Back at the USNM, while no overall philosophy for the collection and preservation of technology collections existed, Watkins succeeded in a significant way. He developed enough of a collection that, by the turn of the century, it held a permanent, if subordinate, place at the Smithsonian Institution. Watkins, with Maynard's assistance, negotiated to keep the technology collections alive and physically present at the National Museum. After Watkins and Maynard, the very presence of the great number of machines and other technological artifacts in the National Museum established as a physical fact the notion that culture also included technology, particularly in the United States. They had brokered an enduring place for technology. Without the work of Watkins and Maynard, no foundation would have existed upon which to build the USNM technological collections in the latter half of the twentieth century.

Watkins and Maynard, as culture brokers, found people in both the museum world and the outside technological community to work with in their mission. They found engineers and

professional organizations outside the Smithsonian–such as the railway engineers, engineering societies, and the public–and certain curators inside–such as Goode and Mason–with which to work. They also used resources from both communities. For example, they drew upon the experience of the world's fairs and expositions, particularly public popularity, to argue for a permanent version of the same thing in the museum. In addition, they used the tendency in the museum world to accept technology within the important area of anthropology to bypass the reservations of the scientific, museum professionals. Watkins and Maynard learned that the interests of the technologists and the museum personnel often appeared ambivalent or diffuse and open-ended. They left room for cultural exchange, even between two divergent worlds. The engineers and the museum personnel probably even saw the outcome differently. For the engineers, they had a place within the national museum. For the museum, they had collections with a large public interest to legitimize their work.

Watkins, Maynard, and Pangborn mediated between diverse groups and represented engineering and the transportation industry, but they also worked on behalf of the audiences seen at the world's fairs and on behalf of the museum world sector fighting for public education. Watkins and Maynard, and even Pangborn, used public pressure and the popularity of technological and mechanical displays at fairs to negotiate a place for them in museum settings. In the early part of the twentieth century, although the technology collections at the USNM remained far from center stage, they continued to grow and draw large crowds of visitors. The outside forces of public interest and attendance kept the collections alive, and, as will be discussed below, allowed for continued efforts for the technology collections in the twentieth century.

At the end of the twentieth century, the cultural negotiations that Watkins began still occur.[1] One issue concerns the separation of functions that Watkins wanted kept together: preservation of

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[1]The cultural negotiations also continue for the entire Smithsonian regarding its role as a "national" museum. The number of groups lobbying for the "proper" representation of their cultures had been apparent in 1990s controversies regarding several Smithsonian exhibits, including the Enola Gay, the Columbian Quincentenary, and Science in American Life. For information, see Kurin, *Reflection of a Culture Broker: A View from the Smithsonian* (Washington, DC: Smithsonian Institution Press, 1997; Martin Harwit, *An Exhibit Denied: Lobbying the History of Enola Gay* (New York, NY: Springer-Verlag, 1996); Richard H. Kohn, "History and the Culture Wars: The Case of the Smithsonian Institution's Enola Gay Exhibition.," *The Journal of American History* 82 (1995): 1036-1082; Otto Mayr, "The 'Enola Gay' Fiasco: History, Politics and the Museum," *Technology and*

historical technological artifacts and education regarding contemporary and continuing technological developments. Although science museums and science centers appear similar, they differ on their missions. Traditionally, museums dedicate their establishments to the acquisition, preservation, and display of objects and artifacts, and emphasize art, history, or science. Museums of natural history and natural science represent the typical "science museum." These institutions collect scientific specimens and instruments for display. The modern "science center" is a product of recent history. These new science centers represent an answer to local, regional, or national demands for improved science education needs. Science centers de-emphasize artifact collections and encourage participation and interaction with exhibits. These institutions account for most existing museums in the 1990s. The early years of science museums originated from the public display of scientific artifacts, while the modern era uses science and technology centers to promote and popularize scientific education and technological improvements.

This study looked at the efforts to develop technology collections in two different settings, the USNM and the Field Columbian Museum. While some similar personnel negotiated a place for technology at both institutions, some distinct differences point to why the brokering process turned out differently at the two institutions. These differences enlighten us as to the brokering process. The brokering of Watkins and Maynard differed from that of Pangborn. Efforts at the USNM, while representing engineering and technology, worked within the established boundaries. They pushed at those boundaries but did not attempt to break them, only stretch them. Watkins and Maynard tried to negotiate a place within existing museum structures for their collections. Nonetheless, they did not hesitate to use conflicts within the museum community to manipulate the structure. For example, the conflict between the goals of research and the goals of popular education proved useful to Watkins, Maynard, and the technology collections–which lent themselves to popular appeal. In addition, the two institutions differed in fundamental ways. The USNM had become the "national" museum and so had to represent all aspects of national

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Culture 39 (1998): 462-473; Pamela Walker Laird, "The Public's Historians," *Technology and Culture* 39 (1998): 474-485; and Edward T. Lilienthal, "Struggling with History and Memory," *The Journal of American History* 82 (1995): 1094-1101.

development. The United States was "technology's nation;" thus, its national museum could not rid itself of technological collections because of outside pressure regarding what it meant to be a "national" museum. The Smithsonian, as a national institution, has continually expanded by adding new museums to cover "missed" areas. The Field Museum experienced less public pressure concerning its mission and could therefore eliminate its collections in technology.

This dissertation rejects some misinterpretations regarding relationships among museums, engineers, and the public enthusiasm for machines and technology. In his work on technological collections at the Smithsonian, Arthur Molella focused on Watkins and Maynard as curators and historians, but they remained first and foremost, engineers and technologists. While Watkins served as a curator, he remained primarily an engineer and his status in the engineering community continued to concern him. While, in Molella's view, the subordination of Watkins' work within the Anthropology Department may have given Watkins a "broad social and cultural understanding of technology," it nonetheless hurt his real aims: the development of a good collection dedicated to transportation and technology at a major US museum.[2] In addition, as an engineer, Watkins played a part in engineering professionalization, which included distinguishing engineering from other areas of knowledge, such as the physical sciences and anthropology.

The attitudes prevalent at the late nineteenth-century international expositions did not transfer easily to the cultural, permanent setting of the museum world. Museums, rather than celebrating technology and machines, tolerated them. Thus, the accepted connection between international exhibitions and technology museum collections is not as clear and direct as it appears in the work of Eugene S. Ferguson, Bernard S. Finn, Robert Rydell, and Paul Greenhalgh.[3] Researchers tend to investigate science collections and technology collections together. In

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[2]Arthur P. Molella, "The Museum That Might Have Been: The Smithsonian's National Museum of Engineering and Industry," *Technology and Culture* 32 (1991): 264.

[3]See Eugene S. Ferguson, "Technical Museums and International Exhibitions," *Technology and Culture* 6 (1965): 30-46; Bernard S. Finn, "The Museum of Science and Technology," in *The Museum: A Reference Guide*, ed. Michael Steven Shapiro with the assistance of Louis Ward Kemp, 59-83 (Westport, CT: Greenwood Press, 1990); Finn, "The Science Museum Today," *Technology and Culture* 6 (1965): 74-82; Robert Rydell, *All the World's a Fair* (Chicago, IL: University of Chicago Press, 1984); and Paul Greenhalgh, "Education, Entertainment and Politics: Lessons from the Great International Exhibitions," in *The New Museology*, ed. Peter Vergo, 74-98 (London, UK: Reaktion Books Ltd., 1989).

addition, they assume that the relationship between technological museum collections and international exhibitions was similar to the relationship between major museum work and international expositions. Anthropology and natural history existed at the expositions, but they proved central to the museums. Machines and technology held great weight at the center of Philadelphia, Chicago, and the other expositions, but they remained far from center at contemporary museums. These differences mattered in the relationships between science collections and technology ones and between curators and supporters of each area.

This study links work in the fields of the history of technology, the history of engineering and museum history. Museums, as cultural institutions, prove to be a key element in large technological systems. These systems include not only people and organizations involved in the development and invention of machines and technology but also the use and representation of the system and its culture. In the view of one museum historian, Joel Orosz, the nature of the "American" museum had been set by 1870.[4] However, the continued rapid development of technology, the professionalization of engineers, and the public enthusiasm for technology played roles that changed the nature of the museum after 1870 and Orosz's "compromise." Efforts at breaking the compromise upset its balance and proved to be a part of the struggle to establish technology collections. In addition, Orosz's description leaves a third group, the public, out of the compromise. The cultural imperatives expressed through the public also played a role in the determination of museum missions.

As seen in the foregoing study, the struggle for a place for technology in the American museum touched on several concepts. The nature of nineteenth-century American technology inspired a fascination with and enthusiasm for its machines and structures. However, mechanical characteristics of grandiosity and movement did not fit well into the established museum world of science and high culture. Nonetheless, J. Elfreth Watkins and George Maynard found a place for technology as they mediated between the culture of technology and the museum world.

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[4]Joel J. Orosz, *Curators and Culture, The Museum Movement in America, 1740-1870* (Tuscaloosa, AL: University of Alabama Press, 1990), ix.

In the struggle for representing technology in the nation's leading museums, key conflicts existed between elite and popular culture, between fairs and museums, and between science and technology. In the nineteenth century, the tension in each set of conflicts reinforced those in the other sets. Science was associated with museums and highbrow culture, while technology and machines were linked to the fairs and popular culture. Some recent historians of technology have argued that the study of the science–technology relationship proves to be a "false question" for researchers. Yet, this difference loomed large for the groups negotiating over mechanical and technological collections in the late nineteenth century. In effect, they discussed and debated the relationship between science and technology, and their views and beliefs mattered in the brokering process.

In retrospect, the significance of J. Elfreth Watkins' work lay not only in the issues of the history of technology or museum history but also in the objects and artifacts themselves. The nature of technology itself, its "material culture," had an impact. Watkins and Maynard brought into the museum a large number of objects that could not be ignored.[5] Over the next one hundred years, the Smithsonian administration continually had to deal with the collections that Watkins had accumulated. The subsequent work of Smithsonian curators Carl W. Mitman and Frank A. Taylor would not have been possible without the physical presence of the objects themselves. The brokering process that Watkins and Maynard began did not end with them. Major brokering efforts on behalf of the technology collections at the USNM occurred in the 1920s and later.[6] These efforts based their foundations on the work of the engineer-culture brokers discussed in this study.

During the 1920s, two individuals assumed the role of cultural brokers at the USNM. One was Holbrook Fitz-John Porter (1858-1933), a mechanical engineer; the other, Carl W. Mitman

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[5]The Field Columbian Museum, even after administratively dismantling the DAI, had to deal with the transportation collections for a number of years into the future as well.

[6]The works of Arthur P. Molella and of Marilyn S. Cohen document these efforts well. The following short discussion is partially based on Arthur P. Molella, "The Museum That Might Have Been: The Smithsonian's National Museum of Engineering and Industry," *Technology and Culture* 32 (1991): 237-263, and Marilyn Sara Cohen, "American Civilization in Three Dimensions: The Evolution of the Museum of History and Technology of the Smithsonian Institution," Ph.D. Dissertation, George Washington University, 1980.

(1889-1958), a former mining engineer turned Smithsonian curator. Porter had served as chief of Machinery Hall at the 1893 World's Columbian Exposition. Mitman came to work at the Smithsonian in 1918, around the same time as George Maynard's death. Porter and Mitman met in 1922 to establish a National Museum of Engineering and Industry under the USNM's direction.

Mitman wanted to build a museum around the core of the technological collections he had inherited from Watkins and Maynard. He went to Smithsonian officials for support. However, like Watkins and Maynard before him, he also sought outside support within the engineering and technology communities. He attempted to provide the American engineer with a celebrated place in history. Mitman's efforts also drew upon the continued popularity of the technology collections. Mitman brought to life the technology collections, and, with the help of the Smithsonian's History Division, made them into one of the most popular museum exhibits in the US. Mitman described them as "scorned by museologists but loved by the people."[7] Mitman finally accomplished what Watkins and Maynard had been unable to do–that is, disassociate the engineering collection from the collections representing pre-modern tools and handicrafts (in other words, the collections that tied it to anthropology and ethnology).

In 1922, Porter, who had worked as a consulting engineer since 1878, approached the Smithsonian to donate some engineering items. The Smithsonian turned him down due to a lack of space. Porter then began his efforts to establish a National Museum of Engineering and Industries.[8] He appealed to engineers' self-esteem and their desire for social recognition as well as to nationalism. Britain, France, Austria and Germany had national institutions dedicated to technology and industry. The ultimate technological and industrial power, the United States, should have one as well. Eventually, however, Porter's efforts at brokering ended in his alienation of both the museum world and the engineering community.[9]

Mitman's and Porter's efforts eventually failed. Porter did not negotiate well or represent the engineering community well. Confusion arose over a deal he worked out between the museum

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[7]Carl W. Mitman, quoted in Molella, "The Museum That Might Have Been," 248.
[8]See Cohen, "American Civilization in Three Dimensions," 34, 37.
[9]See Molella, "The Museum That Might Have Been," 254, 258-9.

and the engineering societies. The museum would set aside a site for a national engineering museum and the engineering societies would build it, fill it, and maintain it.[10] However, the societies thought that they had only agreed to add to additional Smithsonian technology and engineering collections. Porter did not convince them to put forward the sums needed to build a new building and the negotiations ended. In 1924, when a national museum of engineering was incorporated with Porter as its secretary, the engineering societies did not cooperate with him. Mitman attempted to work with the engineering community by addressing the secretaries of various societies. However, his concerns came closer to those of the curator than to those of the engineer. His goals of history and preservation mattered less to those interested in founding industrial museums than the display of contemporary technology. In addition, engineering societies associated Mitman with the Smithsonian and the Smithsonian, unfortunately, with Porter. Mitman reported that his contacts in the engineering community wanted nothing to do with Porter.[11]

Mitman's and Porter's efforts nonetheless planted a "seed" for further efforts. In 1928, the Smithsonian called for US government funding for a museum for science, invention, and industry.[12] With the onset of the Depression, the possibility of funding disappeared; however, the goal remained. Discussions continued in the 1930s, but conflict arose between the Smithsonian and outside groups regarding who had the proper knowledge and expertise to oversee the formation of such a museum–engineers and industrialists or museum professionals. Eventually, the Smithsonian pursued a somewhat altered goal on its own: a museum of history and technology as a part of the National Museum complex.

During the 1950s, Frank A. Taylor, Carl Mitman's protégé, oversaw the founding of the new Museum of History and Technology at the Smithsonian. In 1953, Taylor proposed a series of science, technology and industry halls to connect objects and American culture and history.[13]

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[10]For information relating to the proposed national engineering museum, see "History of a Movement to Establish a National Museum of Engineering and Industry," undated, SIA, RU 192, United States National Museum, Permanent Administrative Files, Incoming Correspondence, Box 253.

[11]Mitman to William de C. Ravenel, December 10, 1927, SIA, RU 192, United States National Museum, Permanent Administrative Files, Incoming Correspondence, Box 253.

[12]See *USNM Report, 1928,* 5-7.

[13]See Cohen, "American Civilization in Three Dimensions," 285.

Although he had an undergraduate engineering degree from MIT and he continued some of the patterns set by Watkins, Maynard, and Mitman, he proved to be more a museum professional than a practicing engineer. In fact, from the 1950s on, Smithsonian curators began to move toward museology as a profession and away from the practice of the communities and professions represented by their collections.[14] Nonetheless, Taylor also developed connections to expositions and the railway world. He worked on exhibits and built models in his home in the evenings for the Pennsylvania Railroad exhibit at the Philadelphia Sesquicentennial Exposition.[15]

In 1955, the US Congress approved funding for the new Museum of History and Technology, which opened in 1964. Along with the opportunity for new space came an opportunity for the Smithsonian to create a new kind of institution. The Smithsonian could focus its investigations regarding science and technology mainly on the impact of technological and historical objects on American culture and life rather than on the objects themselves, thus, moving from an internalist interpretation of the history of technology to a contextualist one. The contextualist interpretive model focused not only on technical and design details of the technology but also on the social and cultural surroundings.[16] Marilyn Cohen argues that the museum failed when it did not seize the opportunity to move toward a new kind of museum exhibit.[17] She blames problems with the new Museum of History and Technology on "eighty years of poverty in the curatorial function."[18] However, the engineer-curators of the early years had good connections to the community and culture they represented–a key ingredient for good cultural brokering. By the time of the 1950s and the Museum of History and Technology, the engineer-curators had become curators rather than practicing engineers. They had more pull within the elite cultural world, but perhaps less pull within the communities and cultures they represented.

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[14] For a discussion of the professionalization of Smithsonian curators and "curatorial function," see Cohen, "American Civilization in Three Dimensions," 283-290.

[15]Cohen, "American Civilization in Three Dimensions," 30. Like Watkins, Taylor also toured Europe to investigate technological and industrial museums. He used the money from working on the exposition exhibits and models to fund a trip to London, Munich, Vienna, and Paris.

[16]See below for a brief discussion of contextualist versus internalist history of technology.

[17] For a detailed discussion of the opportunities of and decisions regarding the Museum of History and Technology in the 1950s, see Cohen, "American Civilization in Three Dimensions," 172, 244-258.

[18]Cohen, "American Civilization in Three Dimensions," 297.

Nonetheless, the ties of the technology curators to the engineering and technology community remained strong–in ideas and philosophies at least. The work of historians of technology into the 1970s reflected Watkins' interpretive model of "progress" and his focus on technical details. A series of curators wrote articles chronicling the development of particular areas of endeavor. Bernard Finn, for example, wrote regarding the development of thermoelectricity, the technology of electricity, and the submarine cable. George W. Hilton wrote on the progress of the cable car and the interurban railway. Others wrote on technology pioneers or individual machines similar to Watkins' "epoch-making" inventions and inventors.[19] John H. White, Jr. (1933-) exemplified this tradition. Appropriately, he served as railway curator in the Smithsonian's Division of Transportation from 1958 to 1989. White's work on railways appears reminiscent of Watkins' work. The theme of progress appears in works chronicling the development of the freight car, the passenger car and the locomotive.[20] His research often focused on specific locomotives, specific companies, and specific inventors. It also focused more on technical details of the development–"internalist" history–than the societal and cultural influences and implications–contextual history. In some of Watkins' reports, he had called for that contextual type of history, but he did not set the example in his writings.

The Smithsonian and its curators also played a role in the establishment of the field of the history of technology, its first journal–*Technology and Culture,* and its first professional society–the Society for the History of Technology (SHOT).[21] In the 1960s, the Museum of

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[19]For example, see Bernard S. Finn, *Development in Thermoelectricity, 1850-1920,* Ph.D. Dissertation, University of Wisconsin, Madison, 1963; Finn, "History of Electrical Technology," *Isis* 67 (1976): 31-35; Finn, *Submarine Telegraph: The Grand Victorian Technology* (London, UK: Science Museum, 1973); George W. Hilton, *The Cable Car in America* (Berkeley, CA: Howell-North Books, 1971); and Hilton, *The Electric Interurban Railways in America* (Stanford, CA: Stanford University Press, 1960).

[20]For example, see John H. White, Jr., *American Locomotives: An Engineering History, 1830-1880* (Baltimore, MD: Johns Hopkins University Press, 1968), *The American Railroad Freight Car; From the Wood-Car Era to the Coming of Steel* (Baltimore, MD: Johns Hopkins University Press, 1993), *The American Railroad Passenger Car* (Baltimore, MD: Johns Hopkins University Press, 1978), *A Short History of American Locomotive Builders in the Steam Era* (Washington, DC: Bass, 1982), *The Great Yellow Fleet: A History of American Railroad Refrigerator Cars* (San Marino, CA: Golden West Books, 1986, and *The Island Queen: Cincinnati's Excursion Steamer* (Akron, OH: University of Akron Press, 1995).

[21]For a detailed discussion of the formation and development of SHOT, its members, and its journal, see John Staudenmaier, *Technology's Storytellers, Reweaving the Human Fabric* (Cambridge, MA: MIT Press, 1985), and Staudenmaier, "Design and Ambience: Historians and Technology, 1958-1977," Ph.D. Dissertation, University of Pennsylvania, 1980. Some of the following discussion regarding the Smithsonian-SHOT connection is based on the author's communication with Merritt Roe Smith, a Smithsonian fellow in the history of technology at the MHT

History and Technology served as a vital center for the new field of the history of technology. Early leaders in SHOT included Robert P. Multhauf (1919-), head of the Science and Technology Division at the Smithsonian's Museum of History and Technology (MHT) from 1957 to 1966 and later head of the MHT from 1966 to 1969.[22] Multhauf attended the initial meeting of SHOT in January 1959 and actively solicited contributors for the new journal. In addition, successful SHOT meetings in the 1960s and 1970s occurred when MHT hosted them.

Historians of technology formed SHOT in 1958, they began to publish *Technology and Culture* in 1959, and their central themes and interpretations mirrored the Smithsonian work. At the heart of the new field lay some central questions: How would Western society tell the tale of its technological past? What (or whose) interpretation would be used? The work of Watkins and the Smithsonian technology curators who had followed him provided some answers and a model. "Progress talk" and "internalist" history prevailed. Watkins had constantly toiled toward displays that would reveal history as a series of "epoch-making" inventions. That interpretive model prevailed for many decades, not only within museums but also in historical writing. The history of technology focused on the process of invention and that interpretation linked the words "inventor" and "invention" with internalist history. Thus, the work of Smithsonian technology curators presented a pattern that influenced the questions historians of technology asked about the past.

Just as the early years of the technology collections at the Smithsonian had included historically-minded engineers, the early writings in the academic field of the history of technology included such engineers. This inclusion continued well into the 1960s and 1970s. *Technology and Culture* and the journal's first editor, Melvin Kranzberg, aimed at not only academic historians but also curators, engineers and other technologists. Several Smithsonian curators published in the early issues of *Technology and Culture.*[23] In addition, just as early technology curators at the

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during the late 1960s. [Merritt Roe Smith to author, July 9, 1998, in author's possession.]

[22]Unlike his successors, Robert Multhauf served as director of MHT after having served as an engineering curator. Daniel Boorstin, director from 1969-1974, arrived at the Smithsonian from History faculty at New York University. Brooke Hindle, director from 1974-1978, also arrived at the Smithsonian from the field of academic history. Neither Hindle nor Boorstin had previously served as a curator.

[23]For example, see Bernard S. Finn, "The Science Museum Today," *Technology and Culture* 6 (Winter 1965): 74-82; Robert P. Multhauf, "The Scientist and the 'Improver' of Technology," *Technology and Culture* 1 (Winter 1959): 38-47; Multhauf, "A Museum Case History," *Technology and Culture* 6 (Winter 1965): 47-58;

Smithsonian had struggled to achieve recognition, early historians of technology felt they did not receive enough recognition, particularly among historians of science and in the History of Science Society (HSS). Interestingly, the historians who founded SHOT came together through meetings of the American Society for Engineering Education. In 1958, they went to HSS leadership in an attempt to gain recognition for technology within that field; however, the society rebuffed them, and they founded SHOT that same year.

John Staudenmaier has done the most detailed and comprehensive work on the early history of SHOT; however, the Smithsonian does not figure into his discussion.[24] In some senses, Staudenmaier's work on SHOT appears internalist. The focus in on the journal, not the context–such as museums.[25] While he expressly states that his focus did not include a history of the field, he also states that it did include "the language, the themes, and the methodological styles that set the intellectual tone" for SHOT and its journal, as well as "the precise character of SHOT's historical *language.*"[26] The work at the Smithsonian proved to be one source of those languages, themes, and methodologies–a part of what Staudenmaier called the "cultural ambience" and the "shared universe of discourse" in which SHOT members worked. The Smithsonian curators helped set the thematic questions with which early SHOT members researched, and thus, the viewpoint from which they saw the history of technology.[27]

The 1980s brought changes both in SHOT and at the Smithsonian. In 1980, Smithsonian technology curator Robert Post became *Technology and Culture's* second editor after Melvin Kranzberg, one of the society's founders. However, in the 1980s, Post also had a new crop of curators with which to work, most of whom held academic degrees in history. They did not come to the museum from careers in the technology communities as had earlier curators. They

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Multhauf, "Sal Ammoniac: A Case History of Industrialization," *Technology and Culture* 6 (Fall 1965): 569-586; and Robert S. Woodbury, "The Legend of Eli Whitney and Interchangeable Parts," *Technology and Culture* 1 (Summer 1960): 235-253.

[24]See Staudenmaier, *Technology's Storytellers,* and "Design and Ambience: Historians and Technology, 1958-1977," Ph.D. Dissertation, University of Pennsylvania, 1980.

[25] While Staudenmaier notes certain limitations of his chosen method of analysis, he does not list the lack of museums and curators as one of them [*Technology's Storytellers,* xvii].

[26] Staudenmaier, *Technology's Storytellers,* xvii, 24. Emphasis in original.

[27]See Staudenmaier, *Technology's Storytellers,* 20-23.

negotiated within the museum community as full participants with perhaps more internal clout than previous curators, but they were further removed from the communities they represented–engineering, mechanics, and industry. They reflected new tendencies in the history of technology away from internalist and toward contextualist history. The continued existence of a strong internalist history tradition among the Smithsonian technology curators became apparent in conflicts. Brooke Hindle, while director of MHT, referred to the new generation of curators and historians as "darkside" scholars.[28] He mourned the "maligning" of the concept of progress and associated the work of curator David Noble with the darksidedness of the "new" history. Nonetheless, even with the new generation of historians and their shift of focus away from the technical details of the machines, the place that Watkins had built for his machines remained–almost unchanging and oblivious to the curatorial conflicts. Their relevance to the history of technology as pursued in the 1980s and 1990s may have waned but not their physical presence in museums.

In the 1980s, some work at the NMAH still reflected Watkins' methods. Some exhibits remained progress-based, and outside support aided particular exhibit areas. Under the leadership of director Roger Kennedy, the NMAH turned increasingly toward outside corporate sponsorship for some exhibits, such as "A Material World." This turn reflected growing problems with US government funding just as Watkins had sought outside help when his section could not get funded. While Watkins had not been criticized for his negotiations between the museum and outside organizations, the Smithsonian received criticism for working with corporate interests and "selling out" to their worldview.

The staying power of the place negotiated for the technology collections and the methods that Watkins used appears clearly in the current National Museum of American History at the Smithsonian in Washington, DC. Internalist, progressive interpretations remain in the work of some curators and exhibits. In addition, the mechanical and technology collections which Watkins

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[28]Brooke Hindle, "Historians of Technology and the Context of History," in *In Context: History and the History of Technology*, ed. Stephen H. Cutcliffe and Robert C. Post (Bethlehem, PA: Lehigh University Press), 235-239.

and Maynard developed still have a place at the Smithsonian. While academic historians have come to criticize some of those methods and exhibits, millions of visitors still enjoy them. Currently, in the eastern portion of the first floor of the National Museum of American History, visitors can still see the basic elements of the nineteenth-century mechanical and technology collections, including galleries for "Railroads," "Road Transportation," the "American Maritime Enterprise," "Bridges and Tunnels," "Electricity," "Power Machinery," and "Agriculture," as well as a gallery of that "legion of strong angels"–the "Engines of Change"– and a prominent display of the *John Bull* locomotive. [See Figure 1 for a layout of the first floor of the National Museum of American History in 1997.] Within the "Engines of Change" exhibit, the museum visitor can see an entire area dedicated to the history of the *John Bull,* including a video showing the locomotive in motion. On September 15, 1981, Watkins' successor, John White, in commemoration of the locomotive's one-hundred-fiftieth birthday, ran it on the rails of the Chessie System's old Georgetown Branch along the Chesapeake and Ohio Canal in Washington, DC. White and the Smithsonian staff had spent over a year analyzing the locomotive and preparing it for use.[29] The risk of damage to an important American artifact remained a main consideration throughout the process. Nonetheless, during tests of the engine in 1980 and the full operation in 1981, historians gained insights into the history and design of locomotives of that era that could not have come in any other way than hands-on experience with the moving, functioning object. The *John Bull* became the oldest operable locomotive in the US, but it also caused controversy. One hundred years after technology first entered the Smithsonian, debate still existed over the best methods of displaying technology and the proper place for that display. Should the Smithsonian preserve technological artifacts within the safe, immobile exhibition environment of traditional museum practice in America? Or should the technology be displayed in all the loud, moving, steaming, puffing, awesome glory that made it a symbol of American history and progress?

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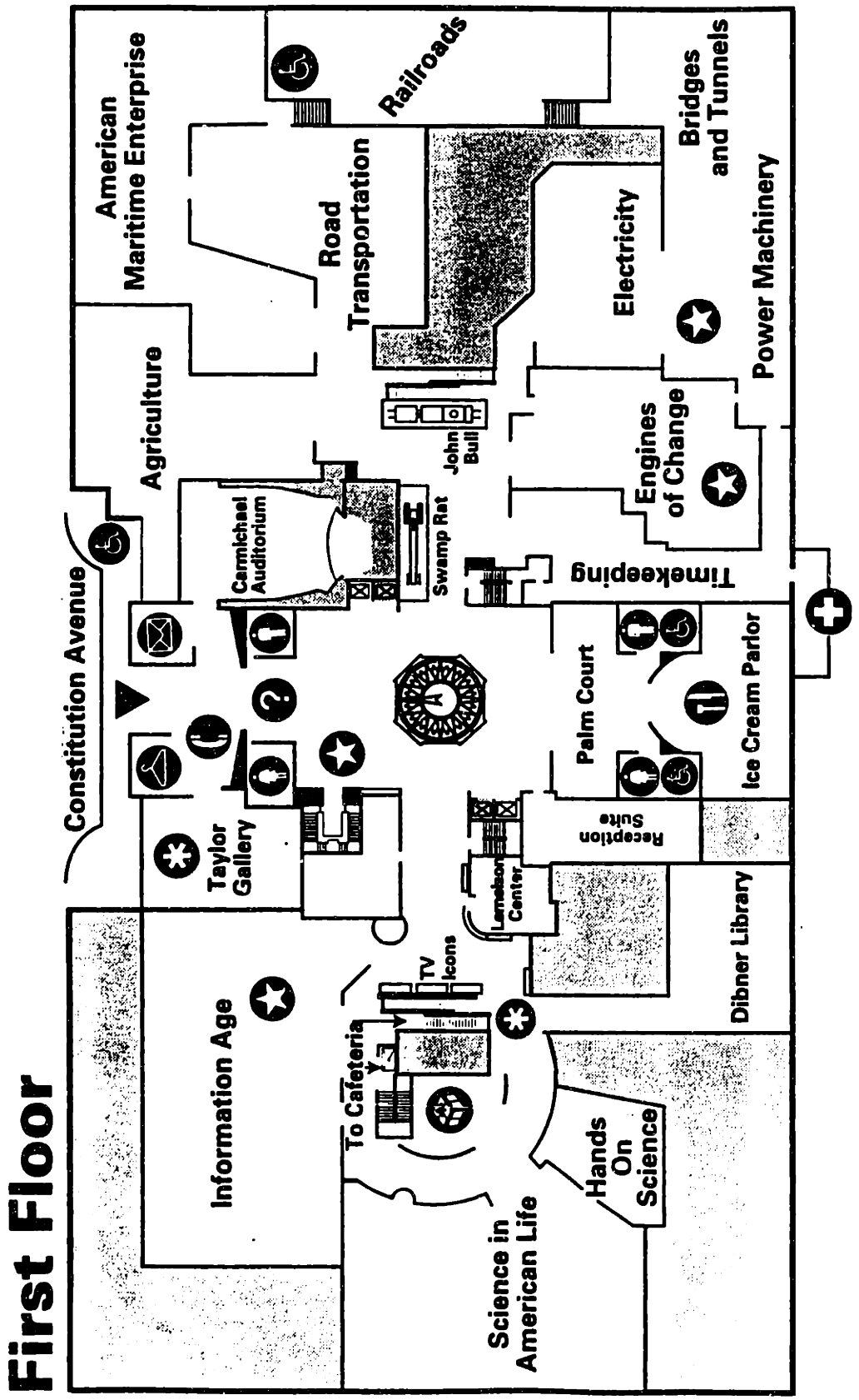
[29]For a detailed description of the analysis and preparation of the locomotive and the 1981 event, see John H. White., Jr., "Resurrection: The *John Bull* Steams Again," *Railroad History* 144 (Spring 1981): 9-28, and White, *The John Bull, 150 Years a Locomotive* (Washington, DC: Smithsonian Institution Press, 1981).

John White seemed to echo Pangborn when he asserted that "the historian's challenge is to break through conventions that predispose us to regard objects from the past as remote and obscure. A sensitive observer must come to understand that artifacts such as the *John Bull* were once the undistinguished concomitants of everyday life."[30]

[30]John White, "Resurrection: The *John Bull* Steams Again," 28.

FIGURE 1.

Floorplan of the First Floor of the National Museum of American History, circa 1997.
[From "National Museum of American History" visitor map, 1997.]



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