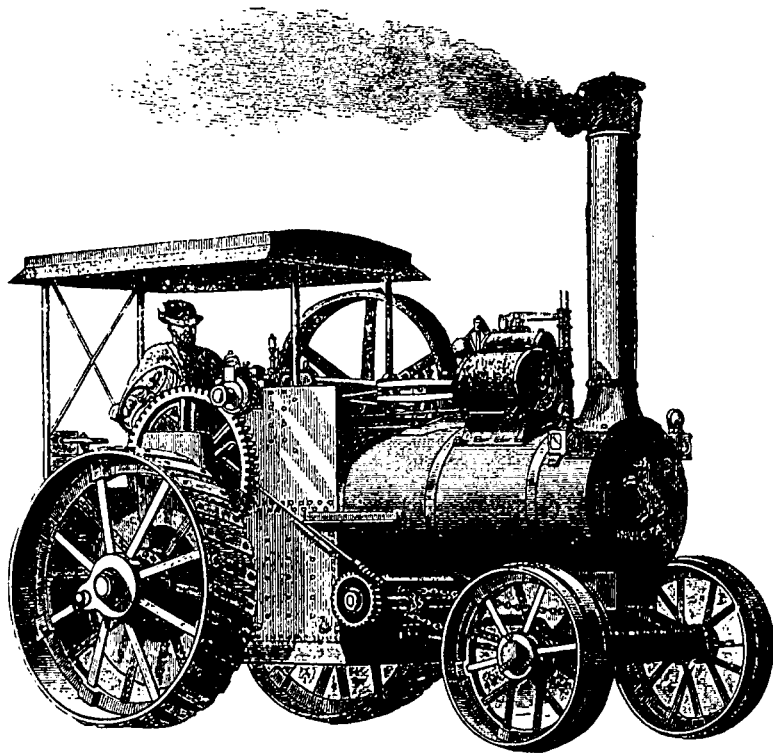


THE FRANKLIN INSTITUTE And the Making of Industrial America

Guide to the Microfiche Collection

Edited by Stephanie A. Morris



CIS Academic Editions

THE FRANKLIN INSTITUTE

And the Making of Industrial America

THE FRANKLIN INSTITUTE

And the Making of Industrial America

Guide to the Microfiche Collection

Edited by Stephanie A. Morris

CIS Academic Editions
Congressional Information Service, Inc.
Bethesda, Maryland

CIS Staff

Editor-in-Chief, Special Collections **August A. Imholtz, Jr.**
Project Editor **John Heffernan**
Staff Assistant **Monette Barreiro**
Production **Dorothy W. Rogers, Debra G. Turnell**
Communications **Richard K. Johnson**
Data Processing **William DeRoche**
Printing Services **Lee Mayer**
Cover Design **Alberto Insua**
Microfilm Operations **William Idol**

Library of Congress Cataloging in Publication Data

CIS Academic Editions, Congressional Information Service, Inc.
4520 East-West Highway, Bethesda, Maryland 20814 USA

© 1987 by Congressional Information Service, Inc. All rights reserved.

Printed in the United States of America

CONTENTS

NOTE FROM THE PUBLISHER	vii
PREFACE	ix
NOTE ON MICROFILMING PROCEDURES	xi
THE DYNAMICS OF CHANGE: The Franklin Institute and the Making of Industrial America	
Overview	1
Education	2
Encouragement of Invention	3
Scientific Investigations	3
Alexander Dallas Bache	4
Standardization	5
Exhibitions	6
Change and the Institute	7
Bartol Research Foundation	9
Institute's New Building	9
Notes	11
List of Plates	13
Plates	
BIBLIOGRAPHY OF DOCUMENTS	
Manuscript Materials	
Membership Account Books	15
Minutes of Meetings	16
Sections, 1869-1923	17
Committee on Instruction	21
Special Committees	24
Correspondence	27
Exhibitions	30
Bartol Research Foundation	40
Commemorative Volumes	40

Iconographic Materials	
Lecture Lantern Slides	41
Welsbach Collection	43
Midvale Steel Company Collection	44
Frederick Graff Collection	45
Naval Architecture	51
Wright Brothers Collection	61

INDEX TO NAMES OF INDIVIDUALS AND ORGANIZATIONS	63
-------------------------------------------------	----

NOTE FROM THE PUBLISHER

Under a National Historical Publications and Records Commission (NHPRC) grant the archivists and staff members of the Franklin Institute, who are acknowledged by Stephanie A. Morris in her preface to this volume, selected from the Institute's archives historically representative manuscript and iconographic materials documenting the Franklin Institute's important role in the making of industrial America. The same NHPRC grant also supported both the writing of the finding aid, the final version of which was edited independent of NHPRC by Congressional Information Service, Inc. (CIS), and the production of the microfiche masters which were filmed in conformity to NHPRC technical standards by a firm other than CIS. CIS assumed responsibility for publishing the finding aid and manufacturing and marketing distribution copies of the microfiche collection.

However, in producing the microfiche collection for distribution and in verifying the finding aid descriptions, CIS discovered that some of the frames were very difficult to read. Every effort has been made by CIS to identify any truly illegible frames which escaped earlier scrutiny in the filming process and then to locate and to refile those original documents which were capable of being refilmed. The refilmed materials are included on the final 7 microfiche of the collection. An eye-visible asterisk before a frame indicates that frame has been refilmed. For each item that has been marked by an asterisk on the microfiche, a notation appears in this finding aid under that microfiche number and frame reference referring the user to the appropriate microfiche number and frame reference for the refilmed material.

Further efforts have been made by CIS to enhance the image quality of microfiche originally filmed from source documents varying greatly in quality. Many of the early nineteenth century materials, for example, were written in various hands on paper differing considerably in the quality, color, and the care with which the paper documents were preserved. This is especially true of some of the correspondence and internal records. In a few instances in which the already filmed documents were judged to be too difficult to refile satisfactorily, typewritten transcripts of the documents were prepared by CIS and identified in the finding aid and on the microfiche in the same manner as the refilmed documents described above.

In the finding aid, personal names have been indexed throughout when the individual is the author of a lecture or address appearing in the collection. Dates have generally been cited by month and year based on internal evidence in the document. "Circa" has been used when external sources were the source for dating. In cases where no date could be established, "[nd]" was used. Wherever the narrative refers to documents in the fiche collection specific citations have been added. Annotations of specific citations clarify the nature of the document or specific filming features which could cause confusion, such as out-of-sequence items.

PREFACE

This microfiche collection and finding aid are the culmination of more than a decade of work. Bruce Sinclair's original research into The Franklin Institute's history led to an award-winning book and a National Science Foundation grant¹. The NSF funding resulted in the first microform edition—*The Records of the Committee on Science and the Arts of The Franklin Institute 1824-1900*².

A. Michal McMahon secured a National Endowment for the Humanities grant to catalogue other record groups in the historical collections. McMahon also secured the National Historical Publications and Records Commission grant which funded this, the second microform edition of archival records of The Franklin Institute.

A series of student interns and part-time assistants helped the full-time staff in cataloguing and filming the records. A. Michal McMahon, Mark Rose, W. Bernard Carlson and Diane Rosenwasser, the iconographic archivist, all worked to prepare the 536 microfiche for this edition. Filming and production of microfiche masters were done by the James T. White and Co. of Princeton, New Jersey. The duplicate microfiche and this Guide are published by Congressional Information Service, Inc., a leading publisher of indexes and microfiche collections for use by researchers and librarians.

Gladys Breuer, curatorial assistant and keeper of the keys, has kept a watchful eye on the diverse collections and personnel during all phases of this project.

My thanks to all who helped in the past to make this present volume possible.

STEPHANIE A. MORRIS
Temple University
Philadelphia

1. In 1975 the Society for the History of Technology awarded Bruce Sinclair the Dexter Prize for his book, *Philadelphia's Philosopher Mechanics: A History of The Franklin Institute 1824-1865* (Baltimore: The Johns Hopkins University Press, 1974).

2. Twenty-eight rolls of microfilm, A. Michal McMahon, editor; Stephanie A. Morris, assistant editor (Wilmington: Scholarly Resources Inc., 1977). See also McMahon and Morris, *Technology in Industrial America: The Committee on Science and the Arts of The Franklin Institute 1824-1900* (Wilmington: Scholarly Resources, Inc., 1977), a calendar of the records.

NOTE ON MICROFILMING PROCEDURES

The National Historical Publications and Records Commission proposal specified that a sampling of the Institute's textual and iconographic archival materials would be placed on fiche. Editorial policies were made several years before this Guide was written, but the outlines are clear. Records of only "internal" interest (financial, building, etc.) were omitted but records of the Institute's involvement with the growing, modernizing technological community were selected for reproduction on microfiche. It was the responsibility of this author to write the Guide; selection and filming of documents were supervised by earlier Institute staff. The Guide has been edited by Congressional Information Service, Inc., of Bethesda, Maryland.

Most of these records have never been published previously in any form in the twentieth century. Portions of the John Lenthall Collection were reproduced in Howard I. Chapelle's *History of the American Sailing Navy* and portions of both the Wright Brothers and Graff Collections have been on exhibit at the Franklin Institute or have been reproduced for exhibit purposes.

Of the records filmed, the items or series selected document significant aspects of the Institute's structure and function. All relevant minute books were filmed. If a series of correspondence contained substantive materials, then the entire series was filmed. In-Coming Correspondence, 1824-1859, shows the international range of the Institute's contacts as well as the local involvement. In-Coming Correspondence (i.e. correspondence received by the Secretary or Actuary) after 1859 was not filmed because it was generally routine; the more substantive correspondence during that period was addressed to specific committees and forms part of the records of those committees.

The materials forming this microfiche edition are sufficient, if complemented by suitable secondary sources, to serve as the basis of any of a number of research projects. The individual introductions to the record groups describe some of the research potential of each record group filmed and any specific editorial policies concerning that group.

The microfiche contain negative images for the manuscript materials. The iconographic materials are black and white in order to retain as much contrast and details as possible.

Because the filmed documents are of uneven sizes, different reduction ratios were used as needed. The images are located by row and column designations. Each microfiche itself has a unique numerical descriptor. The horizontal rows begin at the top of the card, row A, and proceed downward, rows B, C, etc. Columns are counted from the far left to the far right; the upper left-hand corner of fiche 330 would be 330 A-1—fiche number 330, row A, column 1.

Pages of a periodical may have been double-shot, i.e. filmed two open pages at once. In this case, page one would be A-1, page two would be A-2, etc. For the large pages of the 1884 and 1885 Bulletins, for example, one page does not fit on a normal viewer screen and one page is given one location designation. Thus for large size periodicals or scrapbooks, page one is A1, page two is A2, etc.

Eye-visible labels or targets were not counted in assigning locations. Thus although the words PORTRAIT GRAFF, SR., appear in the upper left-hand corner of microfiche 372 (Graff Collection), followed by the image of Frederick Graff, Sr., the actual portrait is given the location 372-A-2.

Charles Wilt, Librarian of The Franklin Institute, and Thomas Whitehead, Head of Special Collections, Paley Library, Temple University, have been of inestimable assistance in helping me work in a new medium microfiche. I am grateful also to Allen F. Davis, Temple University, for an early reading of the introduction. They also helped to improve the Guide, any remaining lack of clarity is solely my responsibility.

THE DYNAMICS OF CHANGE: THE FRANKLIN INSTITUTE AND THE MAKING OF INDUSTRIAL AMERICA

OVERVIEW

A group of industrialists and scientists met in 1824 in Philadelphia to form what would evolve into the most successful American representative of the mechanics institute movement. Practical men such as Samuel Vaughan Merrick, an iron founder, and academics like William H. Keating, the European-trained professor of chemistry and mineralogy at the University of Pennsylvania, joined to form The Franklin Institute for the Promotion of the Mechanic Arts. The Institute's members soon initiated a series of scientific investigations which brought the new organization local and international recognition. Local papers reprinted the remarks of the editor of the London Mechanics' Magazine comparing The Franklin Institute's "extensive experiments" with the work expected of the newly formed British Association for the Advancement of Science¹. A series of exhibitions of domestic manufactures placed the finest examples of American products before the American people. Through its monthly meetings and the *Journal of The Franklin Institute* the scholarly community learned of the changing frontiers in the strength of materials, standardization of weights and measures, and other areas of fundamental interest to scientific and technological progress.

Professionalization of the national community of scientists and engineers overtook the pioneering private society by the last decades of the nineteenth century. Furthermore, the increase in the number of universities and industrial research programs and the specialization of the engineering professions would diminish the impact of the comprehensive Institute. Through a series of modifications the Institute rose to meet the demands of sponsored research in the half-century following the first world war and to pioneer in popularizing scientific education.

This Guide describes the documents selected for inclusion in the microfiche edition of The Franklin Institute and the Making of Industrial America (see Note on Microfilming Procedures for an explanation of the selection procedures). The materials filmed illustrate the dynamic vigor of the young Institute, boldly initiating a scientific investigation into the causes of steam-boiler explosions and eagerly gathering a panorama of domestic products for display. Records in this collection also reflect the maturing Institute, working with the new specialized societies to promote further the beginnings of the electrical science and industry. The first series of modifications which changed the all-encompassing early Institute into a modern organization is also part of this important history of American scientific and

technological growth. No organization with close ties to the academic, mechanic and engineering communities could survive for over a century and a half without experiencing some of the radical changes that the larger communities had undergone since the first quarter of the nineteenth century. This microfiche collection, finally, documents these changes as it reproduces portions of The Franklin Institute's history.

Philadelphia in the 1820s was still a leading center of science and commerce. The American Philosophical Society, the Academy of Natural Sciences of Philadelphia, the University of Pennsylvania with its medical school, and other institutions of learning grew in an environment conducive to scientific endeavors and friendly to its practitioners. The Franklin Institute's membership had ties to these organizations. Samuel Vaughan Merrick's uncle, John Vaughan, was Treasurer of the American Philosophical Society in 1824. William H. Keating had studied at the University of Pennsylvania before continuing his studies in technical schools in France and Switzerland. Other early Institute members strengthened and enhanced the Institute's links to Philadelphia's intellectual and cultural circles. Matthew Carey, vice-president and chairman of the Board of Managers until 1826, was a publisher and had been one of the founders of the Pennsylvania Society for the Promotion of Internal Improvements in 1824. Robert M. Patterson, holder of the Institute's chair of natural philosophy in 1824, held the same post at the University of Pennsylvania. Keating, holder of the chairs of chemistry and mineralogy at the Institute, held the same posts at the University of Pennsylvania. Both Patterson and Keating were also secretaries of the Philosophical Society in 1824².

EDUCATION

Education was an important early activity at The Franklin Institute, but a debate over the structure and function of the course of instruction interfered with the support such a school program required. Should the Institute offer free education for the working class (as benevolent societies did), or a classical school during the day for the upper classes, or an English school with a blend of science and college preparatory classes? These same issues caused controversy at other institutions across the nation during the nineteenth century³.

The Institute began by offering a classical high school education under the direction of Walter R. Johnson, a Harvard College graduate and former principal of the Germantown Academy. This lasted for three years. Johnson then conducted his own school in rooms rented from the Institute for another three years. In 1830 Alexander Dallas Bache, chairman of the Committee on Instructions, advocated a change in the school program. An English school was offered in the evenings under Seth Smith, a local teacher. By 1836 the Institute's involvement with secondary education ended, due in part to the establishment of the Philadelphia public school system, and it focused its instructions in the areas of prime concern to the scientific and business communities—mathematics and mechanical drawing. These programs were never large but did enjoy moderate success. The courses of instruction underwent a variety of changes throughout the century; a course in stenography was added and the whole program was reorganized as the School of Mechanic Arts in 1910. By the early twentieth century universities and agricultural schools, however, were offering advanced study in science and engineering. High schools began to offer phonetic writing, including shorthand and stenography. Realizing that the

Institute was duplicating instruction offered elsewhere, in 1923 the Committee on Instruction closed the Institute's pioneering efforts in the fields of secondary and vocational education⁴.

An adult education program was offered through evening lectures by Institute members such as Peter A. Browne, Robert M. Patterson, and William H. Keating. These often were published in the *Journal of The Franklin Institute* for wider distribution. Later in the century the lectures were illustrated with lantern slides. Topics covered included a wide range from natural philosophy to street lighting, smoke nuisance from the burning of coal, municipal water supplies, and the newest advances in almost every area of science (see the section of the Guide on Lecture Lantern Slides for a sample of lectures, and on the Minutes of Meetings for a list of speakers and topics).

ENCOURAGEMENT OF INVENTION

The Franklin Institute promoted the mechanic arts actively as well as passively through the transmission of cumulated knowledge. The Board of Managers appointed a Committee on Inventions to advise and encourage inventors. Working through subcommittees, these men examined and reported on inventions or theories submitted to the Institute. In 1834 the committee was reorganized and expanded to include other members than those on the Board of Managers. The resolutions governing the new committee specified an "unlimited" number of members who would enroll their names in the roll book. The Committee on Science and the Arts would examine "all inventions that may be submitted" making "detailed, descriptive reports thereon, giving their opinion with candor and impartiality . . ." The reports would include an analysis of the invention in terms of its usefulness and practicality, its simplicity and availability.⁵

By mid-century the applications covered a wide range of inventiveness and soon included specialized industries. The Committee drew upon the diverse expertise within the Institute's membership and referred inventions submitted for examination to specialized discussion groups called Sections, formed during the last quarter of the nineteenth century. Thus, electrical applications were referred to the Electrical Section and chemical compounds to the Chemical Section for report.⁶

The Committee on Science and the Arts also awarded medals to inventors for particularly excellent or ingenious inventions. Applications for these awards increased rapidly both in quantity and scope. Since no one group of volunteers could continue to investigate every advance in "Science and the Arts", the Committee was restructured again, this time narrowing its activities to honoring the more exemplary advances in science, engineering, and business with a medal and certificate. These awards are still presented at the Institute's annual Medal Day.

SCIENTIFIC INVESTIGATIONS

Particular topics of concern to the budding technological communities came in for special investigation. In 1829, Samuel Vaughan Merrick proposed a series of tests of water wheels because the value of water as a prime mover and its effect on different kinds of wheels "has never been fixed by actual experiment on a scale of sufficient magnitude to settle principles upon which it is to be calculated"⁷. The Board of Managers appointed Merrick, Benjamin Reeves (nail manufacturer), Isaiah

Lukens (machinist), Rufus Tyler (machinist), and Andrew Young to a committee to devise a series of experiments to determine these principles. The Committee issued a circular, on March 16, 1829, inviting drawings and papers from every "gentleman conversant" with water wheels and soliciting subscriptions to underwrite the tests. Correspondence came from Brandywine, Lowell and Paterson; subscriptions came from E.I. duPont, from John Colt, agent of the Society for Establishing Useful Manufactures, and from Warren Colburn of the New England Society for the Promotion of Manufactures and the Mechanic Arts. (See records of the Committee on Water Wheels for circular and correspondence, and the section of the Guide on Special Committees-Committee on Water Wheels)

To help plan and carry out the experiments, James P. Espy, chairman of the Institute's Committee on Meteorology (in 1831), Matthias Baldwin, the railroad manufacturer, John Levering, John Agnes (partner in S.V. Merrick and Company), Samuel Haines, Frederick Graff of the Fairmount Water Works, Keating, and James Rush (partner in Rush and Muhlenberg, who were builders of high pressure steam engines and some of the experimental equipment for the tests) were added to the Committee. A structure was erected to house the equipment. Tests would determine the time it took a measured amount of water to raise a given weight to a given height. A bell was rung as the valve opened and another as the weight was raised. Accurate timepieces were used to measure the interval between the bells. Four different size wheels were used and different bucket constructions were tested. Water was admitted from seven chutes in different positions. It was a sophisticated facility, designed to test all possible variables under conditions of the strictest accuracy⁸.

The water wheels experiments were the Institute's first large scientific undertaking, a pioneering endeavor recognized internationally. While these tests were underway, William H. Keating suggested a second series of investigations. A new power source attracted the interest of these men of science and business—steam boilers. A number of explosions, however, was creating fear and doubt concerning the safety (and wisdom) of steam boilers. Investigations were needed in order to ascertain the causes of the explosions and hence a way to avoid them. A circular letter was issued again (reprinted in the *Journal of The Franklin Institute*, Vol. 10, pp. 35-37) and a committee was formed. This new committee designed the first machine to test the strength of materials⁹. Walter R. Johnson, physicist and principal of the high school, chaired the subcommittee on the strength of materials. Keating was originally the chairman of the entire committee but had to withdraw. A new Institute member, Alexander Dallas Bache, nominated by Samuel Vaughan Merrick, was appointed to chair the committee. Alexander Dallas Bache, the greatgrandson of Benjamin Franklin and a West Point graduate and professor of natural philosophy and chemistry at the University of Pennsylvania, was named to fill this vacancy.

ALEXANDER DALLAS BACHE

Twenty-three years old when he joined the Institute in 1829, Bache soon invigorated some of the most important committees¹⁰. He was elected to fill a vacancy on the Board of Managers in 1830 and remained on the Board until he left for Europe in 1837 and then served again from 1839 until he left for Washington, D.C. in 1843 to become the superintendent of the U.S. Coast Survey. In 1836 he became the first president of Girard College but a delay in the opening of the college prevented him from assuming that position. During the interval he toured Europe, purchasing

scientific equipment and books for Girard College¹¹. Bache was on the Committee on Inventions for three years and then chaired its successor, the Committee on Science and the Arts, for another three years. He chaired the Committee on Instructions for seven years and the Committee on Publications for four of his eleven-year appointment to it. He was the first chairman of the monthly conversation meetings and was involved with the committee for five more years. In addition to these appointments (and his teaching duties), Bache served on special committees, being a late addition to the waterpower committee and succeeding Keating as chairman of the steam boiler committee. The tests of this last group were carefully conducted and the detailed reports compiled were marked by a careful application of scientific research methodology to a critical problem in an industrializing society.

Bache, and young men like him with academic training in science, fostered a streamlining of the Institute and focused its activities on the areas of science, technical research, and professional education. The Institute's English school, as noted above, dates from Bache's appointment to the Committee on Instruction. Layton describes the role of the new technologist in replacing the artisan in the vanguard of technological progress. During his "Philadelphia period," Bache was part of this new breed, working to promote applied science. During his later Washington years, Bache acted as a "self-appointed leader of the scientific establishment." Nathan Reingold describes Bache as promoting the cause of research and the advancement of scientific knowledge. Bache was one of the bridges, connecting the "mirror-image twins" of science and technology in the nineteenth century¹².

In addition to Bache's many well-earned laurels as scientist, educator, and administrator, one other distinction deserves to be mentioned. Bache and other Managers made history in advancing the cause of equality for women by electing the first woman member of The Franklin Institute. Edward Poole, exhibition judge (1825) and school teacher, nominated Mrs. Elizabeth Skinner for membership in 1833. The actuary, William Hamilton, had to write "The persons nominated for membership . . ." instead of his usual "The gentlemen. . ." In December the "gentlemen proposed" the previous month were duly and quickly elected. The Messrs. Merrick and Fraley (Frederick Fraley—a boyhood friend of Bache and an Institute officer) moved that Mrs. Skinner be elected a member when, the minutes discreetly note, "a considerable discussion" took place. A roll call vote was taken and she was elected by a ten to five vote. Mrs. Skinner remained a member for only two years¹³.

STANDARDIZATION

Water wheels and steam boilers were not the only areas of industrialization to be studied by *ad hoc* committees of scientists, engineers, and businessmen. As an unofficial advisor to the government, The Franklin Institute recommended amendments to a Pennsylvania bill on standards for weights and measures in 1837 and presented a similar report to Congress in 1902. These reports recommended adoption of the metric system; in the latter year the committee's report was adopted, but not unanimously, within the Institute. The topic generated considerable debate in the scientific and commercial communities at large as can be seen in the Report on Metric System, 1902, in this collection (Microfiche No. 142). Standards for screw threads were presented by William Sellers, President of The Franklin Institute in 1864. His paper on screw threads became widely known and many organizations adopted the system of designs which became known as The William Sellers' or Franklin Institute system¹⁴. In 1878 the Committee on Instruction was authorized to purchase a

dynamo-electric machine for educational purposes. To determine the one best suited to meet its need, the Institute appointed a committee to conduct a series of comparative tests. Elihu Thomson and Edwin J. Houston, faculty members at Central High School and partners in 1878 in the Thomson-Houston Company, conducted the electrical tests. Both these men later served on similar subcommittees to conduct tests during the 1884 International Electrical Exhibition¹⁵.

All of these tests were conducted very carefully and with precise measurements. The subcommittees prepared statistical analyses of the results. Debates over the relative merits of the systems of weights and measures contain references to manufacturing specifications and national prejudices. There were professional discussions in the rarified air of the academically oriented and in the specialized aura of the machine shops. Was the general public totally ignored in these debates over the future direction and course of American technological development? Certainly not, for the Institute's leadership clearly recognized the general public as an important part of the technological community for they (the public) were the consumers.

EXHIBITIONS

Four elements are essential for technological development: accumulated knowledge, evident need, economic possibility, and cultural and social acceptability¹⁶. The manufacturers of goods hoped to increase the social acceptability of American-made goods (over imported ones) by demonstrating the equality of American and European products. What good was a better mousetrap (or straw bonnet or structural steel) if people bought out of habit and didn't even try items manufactured by local sources?

The Franklin Institute recognized the need for "consumer education." Brown describes the general stores of the mid-nineteenth century as pioneers in "consumer education" because the stores permitted customers to inspect goods even though they did not intend to purchase these items immediately¹⁷. Exhibitions of domestic manufactures, like those at The Franklin Institute, had been permitting potential consumers to inspect goods and talk to the manufacturer or the inventor without the intention of immediate purchase since the beginning of the second quarter of the nineteenth century. Anything made in America of American materials was welcome for display. The primary purpose of the exhibitions was to introduce producer and consumer and thus to stimulate the domestic manufactures (i.e., anything made by hand or machine in America). A secondary object was to stimulate productivity by creating an atmosphere of honorable competition. Producers competed for medals as well as for buyers. Railroad companies were encouraged to fund an award, e.g., a cash prize to accompany the Institute's medal for an improved spark arrestor or coupler.

Exhibitions continued annually until 1828, then biennially or triennially until 1858. As early as 1829 some Managers saw that the annual exhibitions were too much of a good thing. The displays of American productivity required a lot of work. The six member standing committee needed a two-hundred member subcommittee on Arrangements to organize the practical details. Exhibitors had to be found and convinced to exhibit; insurance and lighting had to be provided; and, a hall big enough to house everything had to be found. This last detail was a major problem. The first exhibition was held in Carpenters Hall from October 18 to October 20, 1824 and had seventeen categories of exhibits. The twenty-sixth exhibition was

held in the State Armory, from October 15 to November 13, 1858, with forty classes of exhibits. Once the hall was hired, committees of judges were sought; each class or category of exhibit needed a committee to determine which, if any, of the items displayed deserved an award. The judges would recommend items for the first (gold), second (silver), or third (bronze) class medal or certificate of honorable mention. As no judge could receive a medal for an object he exhibited if he were a judge of the same class of exhibits, finding qualified judges was often difficult.

But once all the preparations were made, the exhibition was opened to the press, to groups of school children, and to the general public. Members of The Franklin Institute were admitted free to the exhibition but others had to buy a ticket. An admission fee was first charged in 1826; it helped to reduce the inconvenience of crowds swelled by the "indolent and useless persons" who gathered when "gratuitous admission" is permitted¹⁸. Many exhibits were sold while on display, thus saving the return freight costs. Judges reviewed the items in a class and prepared a report with an inventory of items in that class. Remarks on the merits and cost of items appear as marginal notes in these inventories and as part of the report. The judges' reports were summarized and included in the General Report of the Chairman of the Committee on Premiums and Exhibitions. The Chairman's report was frequently printed in the *Journal of The Franklin Institute* or issued as a separate pamphlet. Judges often noted special features of the exhibits, e.g., work done by children or by self-taught mechanics (male or female), and, of course, the superiority (or the equality) of the American-made item to the imported one.

Exhibitions soon ceased to be the only way of stimulating domestic production and consumption. Magazines, and the advertisements in them, provided regular opportunities for comparison shopping in the quiet of one's own home. Department stores (and general stores, but on a smaller scale) provided this same service in three dimensions; and mail-order catalogues clearly were a much more convenient way of shopping than going to a distant city. By the Centennial decade, exhibitions needed a theme and a special attraction; a panorama of domestic manufactures was no longer sufficient. The Institute's fiftieth anniversary was marked by a general exhibition held in an old railroad depot which, ironically, would become the future home of John Wanamaker's department store. Eight years would elapse before the next exhibition the Institute sponsored in 1884, and it would focus on electricity. The International Electrical Exhibition was the fourth such display in the world and the first in the United States. Here potential consumers could view rooms with electric chandeliers and watch a water fountain illuminated electrically with multi-colored lights. The uncertain consumer could meet with representatives of electrical companies and learn about this new thing—electricity—and how their homes could remain safe with all those wires and electrical devices in it¹⁹. An electrical conference was held concurrently under the sponsorship of the American Institute of Electrical Engineers. Ground work was laid for future electrical conferences which would adopt definitions of standard units of electrical measurement.

CHANGE AND THE INSTITUTE

By the late nineteenth century The Franklin Institute was no longer the agency best suited to effect large-scale changes in the technological community. The National Academy of Sciences, founded in Washington, D.C., during the Civil War became the official advisor to the government. Joseph Henry, Princeton scientist and Bache's friend, earlier had gathered some of the Institute's activities under the

mantle of the Smithsonian Institute, founded in 1846. Throughout the century, The Franklin Institute had maintained a network of meteorological observers, and had published tables of the accumulated data in its *Journal*. The Committee on Meteorology's records include guidelines from various state agencies as well as individual observations. But even having a member, Charles B. Trego, in the state legislature and being a worthy cause were not sufficient to secure state funding in 1859 for the analysis and publication of two decades of observation. Joseph Henry, through careful spending of the Smithsonian's funds, could provide financial support for the analysis of data and so the Smithsonian, through his efforts, gradually became the center of a national program. Henry pulled together the efforts of federal, state, and private agencies to form a nationwide system of weather observation and reporting²⁰.

Members of The Franklin Institute's Board of Managers recognized the changes taking place and decided to initiate some of their own. On December 17, 1863, John C. Cresson, president, declined renomination to the office he had held for nine years. Cresson (1806-1876) had been the Institute's third president, after James Ronaldson and Samuel Vaughan Merrick. He had been the professor of Mechanics and Natural Philosophy at the Institute (1837) and at Central High School (1838-1840), a president of the Mine Hill and Schuylkill Haven Railroad Co. (1847), and vice-president of the American Philosophical Society (1857)²¹. Cresson nominated as his successor William Sellers. On the same night, Frederick Fraley resigned as Corresponding Secretary, citing his action as for "the infusion of new spirit"²². The new officers were William Sellers, president; Fairman Rogers, professor of engineering at the University of Pennsylvania, and John H. Towne, partner in Merrick, Towne, and Co., vice presidents; Washington Jones, engineer and member of the American Society of Mechanical Engineers, recording secretary; Robert Briggs, engineer, corresponding secretary; and John F. Frazer, scientist and Bache's laboratory assistant and successor as professor of chemistry and natural philosophy at the University of Pennsylvania, treasurer. Managers included Charles H. Cramp, iron ship builder; J. Vaughan Merrick of Merrick and Sons; John Gardiner, Jr., brewer; B. Henry Bartol, engineer and director of the American Steamship Co.; Bloomfield H. Moore, paper manufacturer; and Charles S. Close²³.

William Sellers (1824-1905) was the leading Philadelphia machine tool manufacturer. He was president of William Sellers and Co. founded in 1856 and incorporated in 1886, and was also, like Cresson, a trustee of the University of Pennsylvania. After Sellers' death, the Board of Trustees adopted a resolution acknowledging the "valuable" contribution his knowledge and experience had been to the organization and development of the University's school of engineering²⁴.

The new officers were primarily men of practical training and experience. Institute activities consequently shifted toward topics of practical interest. The fourth president did not stay in office long. After three years Sellers withdrew his name from renomination as he felt it in the "best interest" of the Institute to avoid the reelection of officers becoming "a mere matter of form." He nominated as his successor John Vaughan Merrick. Merrick, in turn, remained in office for three years, saying that "occasional changes" of the presiding officers would serve to "infuse vitality and energy into its proceedings." Merrick named Coleman Sellers as his successor²⁵.

William Sellers did not renounce active membership, however, when he declined renomination. He was one of the early members of the first Section—the Mechanical Section, organized in April 1869. Other founders were Coleman Sellers

and Washington Jones; these three, among others, were also members of the American Society of Mechanical Engineers. This professional society was one of the many specialized national organizations which attracted members looking for professional identification, up-to-date information on advances in the field, and a forum for debate. Institute activities began to parallel or duplicate the activities of these associations; for example, the Institute's Report on Metric System, 1902, includes a copy of the proceedings of the American Society of Mechanical Engineers' meeting debating the advantages and disadvantages of the metric system²⁶.

BARTOL RESEARCH FOUNDATION

One institution alone could no longer expect to advance science in as many directions as had the early Franklin Institute. The educational programs were superseded by the secondary school movement of the cities and the scientific schools of the universities; the Sections, established during the last quarter of the century, were superseded by national professional societies. The exhibitions, comprehensive displays of imagination and creativity, yielded in the face of overwhelming volume and complexity. The Franklin Institute had supported *ad hoc* industrial research during its water power and steam boiler explosion investigations. In the early twentieth century this tradition of direct, sponsored research was formalized at the Bartol Research Foundation. Before his death in 1918, Henry W. Bartol, a leading Philadelphia industrialist, bequeathed to the Institute his residual estate for the establishment and operation of a laboratory for research in the physical sciences. The initial site, on Nineteenth Street in Philadelphia, consisted of houses "not raised to be physical laboratories." Each time a trolley went by, measurements ceased as the houses had "the physical steadiness of a teetering mosquito in a gale of wind." A change in location was definitely in order. The Bartol Research Laboratories were relocated on the campus of Swarthmore College. Operations began there in 1928 under the direction of Dr. William F. G. Swann, former professor of physics at the University of Minnesota, at the University of Chicago and at Yale University²⁷.

INSTITUTE'S NEW BUILDING

The 1924 opening ceremonies for the Bartol Research Laboratories had to be held at the University of Pennsylvania as the original home of the Institute was too small. The Institute's Library, once housed on a shelf in a member's home, a century later consisted of 82,941 volumes, 20,655 pamphlets, 2,292 maps and charts, 1,356 photographs, and 784 original drawings and designs²⁸. A committee had been appointed in 1906 to prepare plans for a new building but little became of these plans because of the funding required. In 1927, at a meeting of the Poor Richard Club, a proposal was made that a national memorial should be erected in honor of Benjamin Franklin and that Philadelphia was the most fitting location. The Franklin Institute was invited to participate in the planning meetings. On May 23, 1928 the Managers of the Institute received a proposal from the Benjamin Franklin Memorial, Inc. "for a cooperative scheme for the raising of money" for use in erecting and maintaining a museum and memorial²⁹. Further communication followed. The museum envisioned by the Institute would be a place where "the principles of

science are emphasized, where the scientific fundamentals are displayed as they find application in industry, and where the growth of manufacturing and engineering processes are portrayed with the utmost possible clarity." Visitors to this museum would be encouraged to touch, handle, and operate the exhibits in order to learn how things work³⁰.

The Fels Planetarium opened on November 6, 1933; the Science Museum opened on January 1, 1934 in the new building at Twentieth and Benjamin Franklin Parkway, Philadelphia. The Franklin Memorial Hall with its heroic-sized statue was dedicated in 1938. During the second world war The Franklin Institute Laboratories for Research and Development occupied much of the Science Museum as floor space was converted into wartime research facilities. Altogether twenty-five major projects were investigated by five groups employing 125 persons. The first project related to problems concerning air-borne fire control. The Institute's research staff received two ordnance awards (in 1944 and 1945)³¹. The Franklin Institute Research Laboratories became, as an outcome of its war efforts, a well-equipped laboratory for peace-time industrial research. Its four main divisions were Chemistry and Physics, Electrical Engineering, Mechanical Engineering, and Solid State Physics. These laboratories are now closed due to the rise of parallel research facilities in industries and the universities.

The early twentieth century laboratories were a continuation of the Institute's research tradition; the Science Museum is the successor to its educational programs. Institute officials saw the planned museum as a "vital adjunct to the educational facilities of the city" (and surrounding areas), to provide an opportunity for visitors to realize the vitality and importance of scientific knowledge. An important by-product is the possibility of encouraging some young visitors to consider a career in science or technology³². Annual science fairs also work toward the same goal.

In the history of German hydrogenation, Thomas Hughes found a "technological momentum," a compelling dynamic force fed by technological need and invention and contribution to developments beyond the scope of the purely scientific³³. The Franklin Institute and the Making of Industrial America possesses some of these attributes. Bursting steam boilers led to testing the strength of materials. Better understanding of iron and steel production led to better products and better control of the quality. Exhibitions of domestic manufactures were intended to stimulate domestic commerce. As little shops opened to sell to the new purchasers, the word spread and demand increased. Production increased to meet this demand as did the number of stores. As production increased and diversified, exhibitions could no longer easily provide the access to any and all products. The Franklin Institute sponsored specialized discussion groups to meet the needs of the new professions of mechanical and electrical engineering. By providing a forum for expression, action, and identification, The Franklin Institute became a dynamic force inspiring generations of scientists and engineers. Later generations formed their own societies as more specific forums for debate and these societies now watch over the training and qualifications of succeeding generations of members. In its Science Museum and with its Science Library, The Franklin Institute of the 1980s assists visitors in acquiring a better understanding of the fundamentals of science and engineering and encourages the young to consider a career in these dynamic fields. In this way The Franklin Institute is introducing a potential Sarah Peter or William Sellers to opportunities in constantly changing areas³⁴.

STEPHANIE A. MORRIS

NOTES

1. *National Gazette*, July 7, 1832. For a history of the Franklin Institute's founding see Bruce Sinclair, *Philadelphia's Philosopher Mechanics: A History of The Franklin Institute: 1824-1865* (Baltimore: Johns Hopkins University Press, 1974), pp. 29-35. For Merrick see Thomas Coulson, "Some Prominent Members of The Franklin Institute 1. Samuel Vaughan Merrick, 1801-1870," *Journal of The Franklin Institute*, 258 (November 1954), pp. 335-346. Hereafter JFI. For Keating see John H. Frederick, "William Hypolitus Keating," *Dictionary of American Biography*, ed. Dumas Malone, v. 10 (New York: Charles Scribner's Sons, 1933), pp. 276-277.
2. *Proceedings of the American Philosophical Society*, v.1,pt.1 (January 2, 1824), p. 524. For Carey, see Broadus Mitchell, "Matthew Carey", *Dictionary of American Biography*, v.3, pp. 489-491.
3. See, for example, Michael Katz, *The Irony of Early School Reform: Educational Innovation in Mid-Nineteenth Century Massachusetts* (Cambridge: Harvard University Press, 1969) and Carl F. Kaestle, "School Change, Discipline, and the Common School in Early Nineteenth-Century America," *Journal of Interdisciplinary History*, IX:1 (Summer 1978), pp. 1-17, for discussions of nineteenth century views of education.
4. Alfred Rigling, "Reminiscences of Fifty Years," JFI, 215:3 (March 1933), p. 10. Chronology of schools is found in the reports of the Committee on Instruction and in the annual reports of the Board of Managers.
5. "Resolutions," following Bache's Annual Report, JFI, 13 (April 1834), p. 231.
6. For a calendar of Committee on Science and the Arts subcommittee reports, see A. Michal McMahon and Stephanie A. Morris, *Technology in Industrial America: The Committee on Science and the Arts of The Franklin Institute, 1824-1900* (Wilmington: Scholarly Resources, Inc., 1977), especially CSA #1337 for referral to Electrical Section, #1351 for referral to Chemical Section, #1349 for referral from Board of Judges, "Novelties" Exhibition, pp. 149, 171.
7. Minutes of Board of Managers, March 12, 1829.
8. Two committee reports discuss the test facility. The best source is the first published report of the Committee on Water Wheels, in JFI 11 (March 1831), pp. 145-154. See also Sinclair, pp. 141-147, for a summary of the Committee's work. Committee membership is found in Minutes of Board of Managers, March 12, 1829.
9. Minutes of Board of Managers, May 13, 1830. See also Sinclair, *Early Research at The Franklin Institute: The Investigation into the Causes of Steam Boiler Explosions 1830-1837*. (Philadelphia, 1966).
10. Minutes of Board of Managers, April 9, 1829. For Bache see Louis A. Bauer, "Alexander Dallas Bache," *Dictionary of American Biography*, v. 1, pp. 461-462.
11. For Bache's career, see Sinclair, "Americans Abroad: Science and Cultural Nationalism in the Early Nineteenth Century", *The Sciences in the American Context: New Perspectives*, ed. Nathan Reingold, (Washington: Smithsonian Institution, 1979) pp. 35-53 and Nathan Reingold, "Alexander Dallas Bache: Science and Technology in the American Idiom," *Technology and Culture*, 11:2 (April 1970), pp. 163-177.
12. Edwin Layton, "Mirror-Image Twins: The Communities of Science and Technology," *Nineteenth Century American Science: A Reappraisal*, ed. George H. Daniels (Evanston: Northwestern University Press, 1972), p. 210. See Committee on Instruction, Report, October 13, 1831, for English School. Records of Committee on Instruction, The Franklin Institute.
13. Minutes of the Board of Managers, November 14, December 12, 1833. On the latter date the roll call vote was: Ayes: Ronaldson, Lukens, Fraley, Merrick, Isaac Garriques, Robbins, Lewis, Bache, Buckley, Agnew; Noes: Perot, Tyler, Struthers, Harker, Fox. Membership Account book, vol.B (1831-1839) does not give an occupation for Mrs. Skinner.
14. See Sinclair, "At the Turn of a Screw: William Sellers, The Franklin Institute, and a Standard American Thread," *Technology and Culture* 10 (January 1969), pp. 20-34.
15. An account of the trials is given by Jacob B. Knight, Secretary, in JFI 104 (September 1877), p. 145. Report of the Subcommittee on Electrical Measurements, JFI 105 (June 1878), pp. 361-378.
16. John T. Schlebecker, "Farmers and Bureaucrats: Reflections on Technological Innovation in Agriculture," *Agricultural History* 51:4 (October 1977), p. 650.
17. Richard D. Brown, *Modernization: The Transformation of American Life 1800-1865* (New York: Hill and Wang, 1976), p. 157.
18. See Report of Committee on Exhibitions, December 13, 1826. Detailed finding aids in Franklin Institute's Archives summarize the number of classes, visitors; the halls used, etc. Original information on these subjects is from Reports of Committee on Exhibitions and Subcommittee on Arrangements. See Committee on Exhibitions Report, Jan. 3, 1829, for Merrick's suggestion that exhibitions be held biennially or triennially. Committee on Exhibitions records, The Franklin Institute Archives.
19. General Report, Committee on Exhibitions, p. 16 (Philadelphia, 1885); Catalogue describes exhibits.

20. Sinclair, *Philosopher Mechanics*, p. 243.
21. Minutes of Meetings, The Franklin Institute, December 17, 1863. For biographical information see Frederick Fraley, "Obituary Notice of John C. Cresson," *Proceedings of the American Philosophical Society*, XVII: 100 (1876), pp. 149-160.
22. Fraley to Hamilton, December 17, 1863, read into Minutes of Meeting, December 17, 1863. Minutes of Monthly Meetings, The Franklin Institute.
23. New officers were announced January 21, 1864, Minutes of Monthly Meetings, The Franklin Institute. Biographical information is hard to find on most members; many don't have entries in *Dictionary of American Biography* or *Who Was Who*. Charles S. Close is one who appears in neither reference work; his practical interests may be presumed from an article he published in JFI "Moving Brick Houses," in Civil and Mechanical Engineering section, JFI, 70:3 (September 1875), pp. 178-180. See Thomas Denton McCormick, "John Fries Frazer," DAB, v.4, p. 3; "Memoirs of John Vaughan Merrick," in Mary Williams Brinton, *Their Lives and Mine* (Philadelphia, private printing, 1972), pp. 15-48, for Towne, J.V. Merrick, and Merrick Fraley-Bache friendship. Monte A. Calvert, *The Mechanical Engineer in America, 1830-1910* (Baltimore: The Johns Hopkins University Press, 1967), p. 127 for ASME members Jones, Sellers. Membership Records, FI, frequently gives occupation. See also Carl W. Witman, "Coleman Sellers," "William Sellers," DAB v.8, pp. 574-577 (Coleman and William were second cousins).
24. Alexander E. Outerbridge, Jr. and Coleman Sellers, Jr., "William Sellers," JFI 159:5 (May 1905), pp. 366-368.
25. Minutes of Monthly Meetings, December 19, 1866; December 17, 1869. The Franklin Institute Archives.
26. Committee on Metric System, 1902, *Proceedings of American Society of Mechanical Engineers*, December 3, 1902 meeting. Mechanical Section, petition for formation, 1869. Mechanical Section.
27. Howard McClenahan, "Present and Proposed Activities of The Franklin Institute," JFI 206:6 (December 1928), p. 742.
28. William C. L. Eglin, "Report of the President," *The Franklin Institute Year Book 1924-1925* (Philadelphia, at the Hall of the Franklin Institute, 1925), p. 72.
29. Minutes of the Board of Managers, May 23, 1928. The Franklin Institute Archives.
30. McClenahan, p. 748.
31. Thomas Coulson, "The Franklin Institute from 1824 to 1949," JFI 249:1 (January 1950), pp. 40-44.
32. McClenahan, p. 748.
33. Thomas P. Hughes, "Technological Momentum in History: Hydrogenation in Germany 1898-1933," *Past and Present* 44 (Aug. 1969) p. 106.
34. Mrs. Peter had conducted a school of design for women informally before approaching the Board of Managers for support in 1850. The school operated briefly with Institute support until 1853 and then continued under an independent charter. It later merged with the Moore Institute of Art, Science and Industry and thus formed the basis for the present Moore College of Art in Philadelphia. See Bruce Sinclair, *Philosopher Mechanics*, pp. 261-264, for a brief summary of Mrs. Peter's School of Design for Women.

PLATE 1

Alexander Dallas Bache played a central leadership role in the emergent Franklin Institute and later became first president of the National Academy of Sciences.

PLATE 2

William Sellers, elected president of the Franklin Institute in January, 1864, strengthened the Institute's financial position and deepened its concern with technological problems. His system of screw threads became the U.S. standard.

PLATE 3

Participation of Philadelphia's industry provided both leadership and a far reaching sense of purpose to the Franklin Institute.

PLATE 4

The Franklin Institute's early scientific study of waterwheels helped establish its reputation for promoting the mechanical arts through conducting important technological research.

PLATE 5

The Franklin Institute directed much effort towards the important task of industrial testing and used machines like the pictured tenacity machine. The Institute's work on standard weights and measures reached a climax in its recommendations for U.S. adoption of the metric system.

PLATE 6

Urban lighting was an important development for 19th century America. The Franklin Institute played an important role in the development of Philadelphia's gaslight system. The Welsbach lamp helped the gaslight industry compete with the growth of electrical lighting.

PLATE 7

Advertisement from an exhibition catalog illustrating the kind of technological advances which were important facets of the Franklin Institute's contribution to the growth of industrial America.

PLATE 8

Originally known as Butcher Steel Works, Midvale Steel Co. was renamed in 1873 after William Sellers acquired a major interest in the business. An important tool and ordnance steel producer, it later merged with Heppenstall Steel Co. and continued operations until 1976.

PLATE 9

The library of The Franklin Institute has acquired a significant collection of materials through the Institute's exchange program for its *Journal* with other libraries. The collection development process also provided the basic materials for the Institute's museum.



From a Daguer's type

Engd by L.S. Doolittle

A. W. Bache

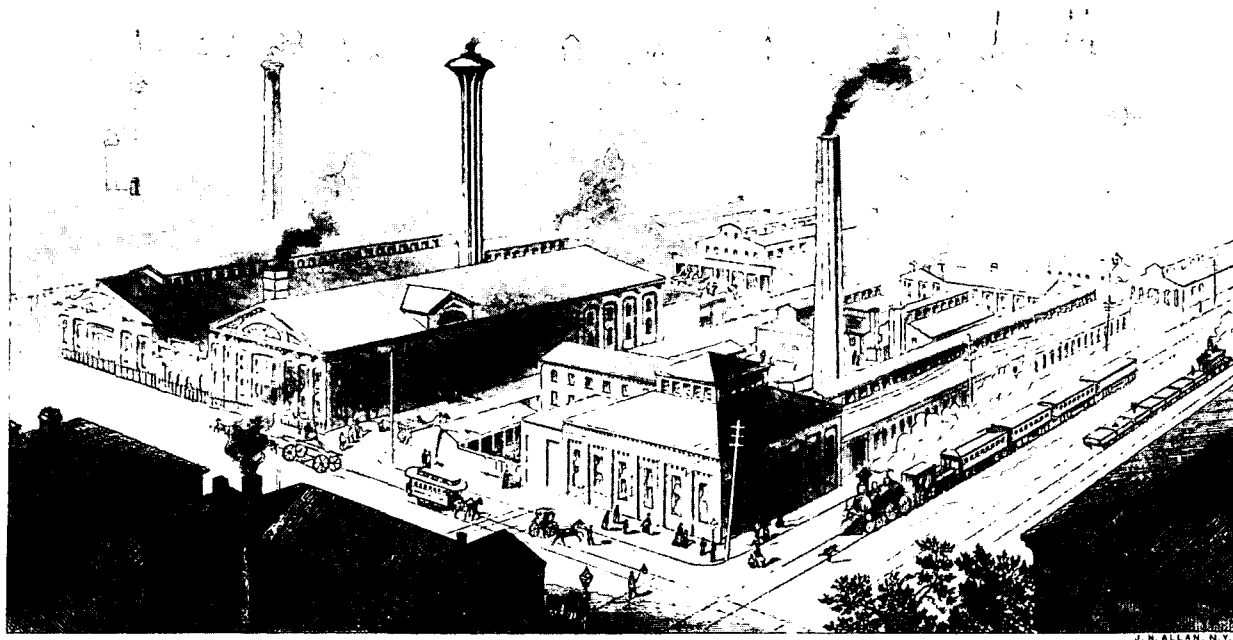
PLATE 1



Photo by F. Gaismanst.

Engraving by Samuel Sarason.

*Wm
u
Sellers*
— " —



J. N. ALLAN, N.Y.

Wm. Sellers & Co.
Philadelphia.

PLATE 3

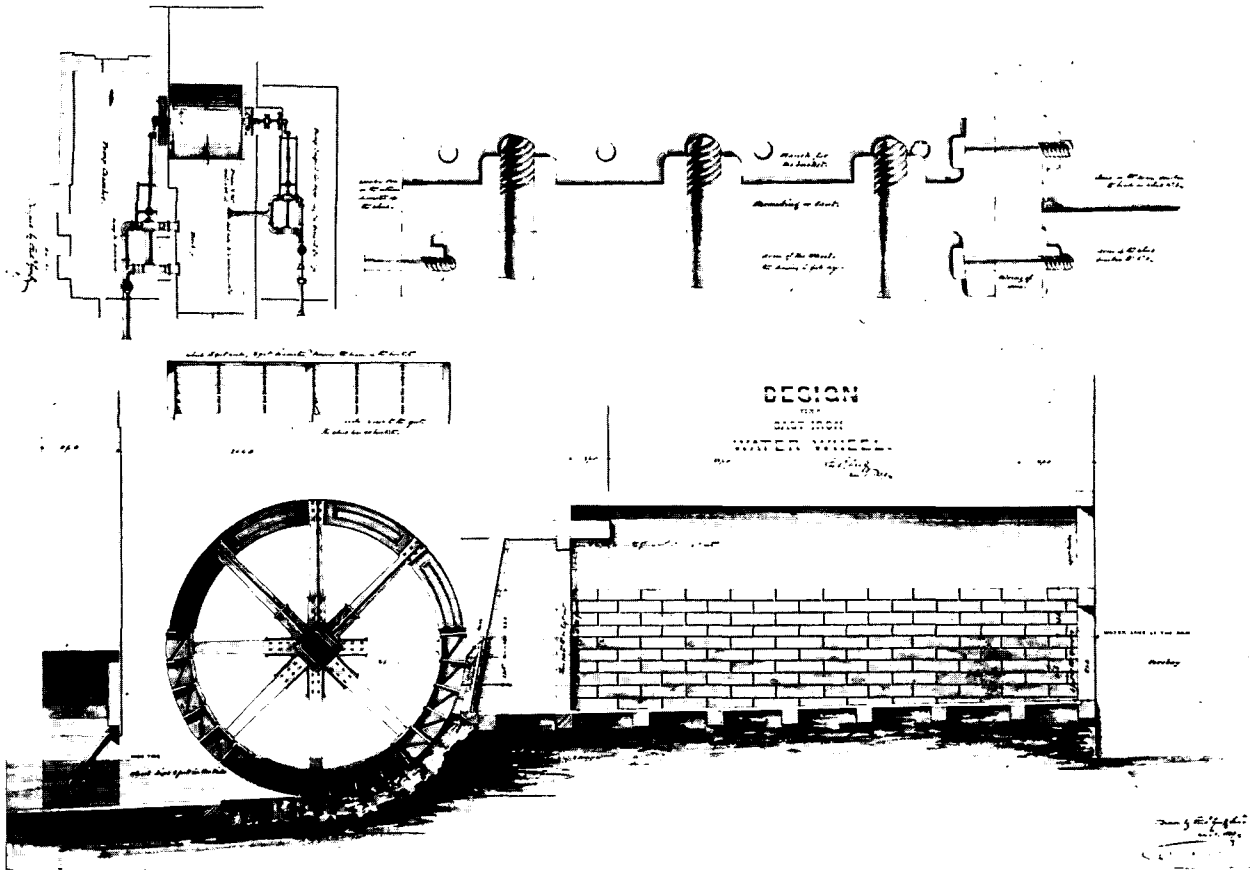
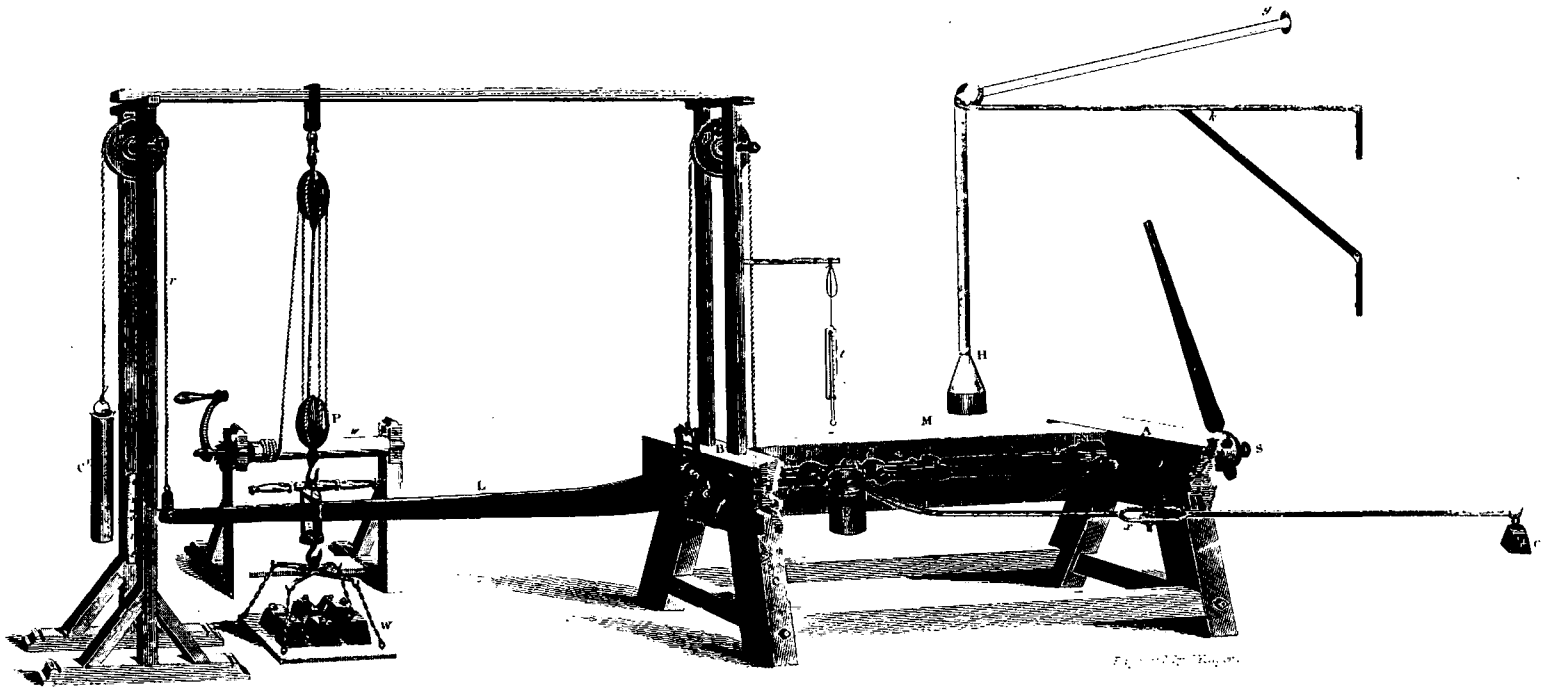


PLATE 4



Des. by R. Mason

Fig. 1. Machine for Proving Tenacity.

MACHINE FOR PROVING TENACITY.

PLATE 5

Welsbach Junior

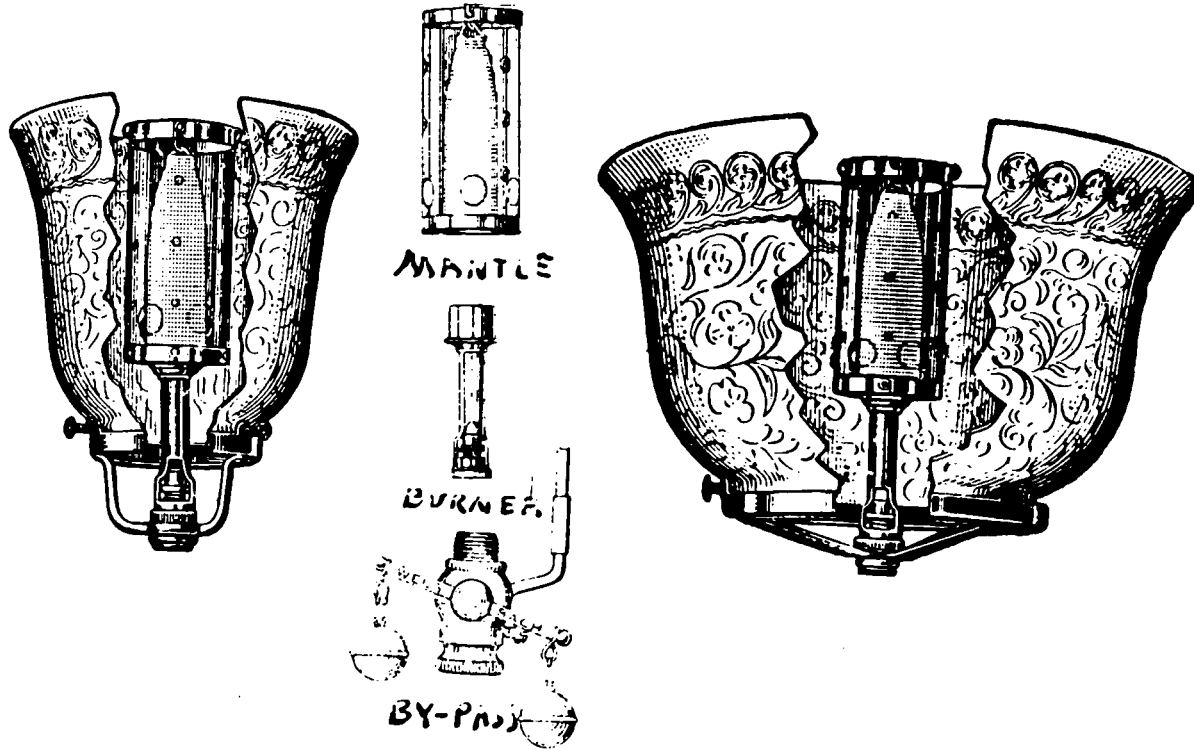
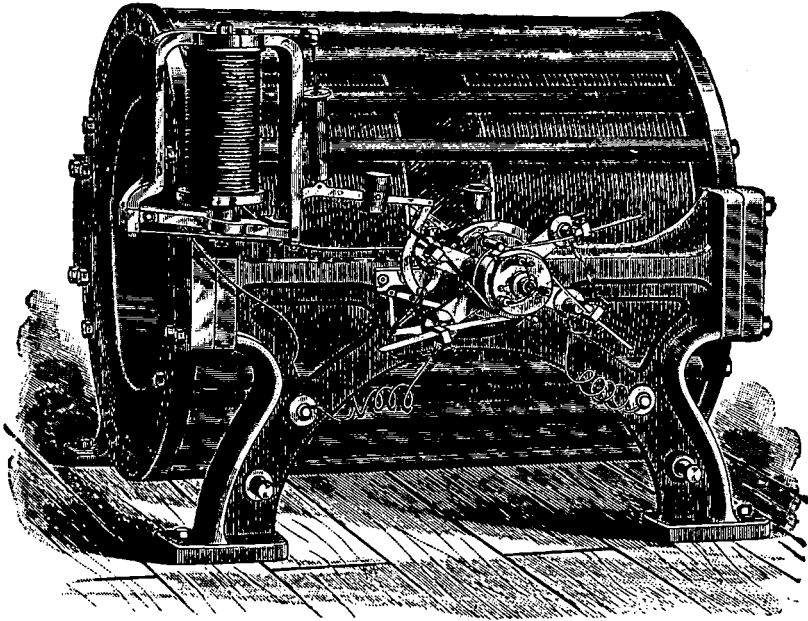


PLATE 6



The Thomson-Houston System.

DYNAMO MACHINES,
 AUTOMATIC REGULATORS,
 REGULATOR MAGNETS,
 SINGLE ARC LAMPS,

HALF-ARC LAMPS,
 INCANDESCENT LAMPS,
 DISTRIBUTION SWITCHES,
 ELECTRIC MOTORS,

AUTOMATIC CUT-OUTS,
 ABSOLUTE CUT-OUTS,
 DUPLEX ARC LAMPS,
 FOCUSING ARC LAMPS,

ORNAMENTAL LAMPS, SWITCH-BOARDS,

ARC LAMPS FEEDING CARBON PENCIL DIRECT,

ARC LIGHTS RUNNING IN MULTIPLE SERIES,

INCANDESCENT LIGHTS ON ARC LIGHT CIRCUIT,

LILIPUTIAN WORKING PLANT SHOWING SYSTEM COMPLETE.

**YOU CANNOT AFFORD to BUY or USE ANY OTHER
 SYSTEM of ELECTRIC LIGHTING.**

CARDS, ILLUSTRATED PAMPHLETS, ETC., TO BE HAD IN THE EXHIBITION.

ADDRESS OF PARENT COMPANY:

THE THOMSON-HOUSTON ELECTRIC Co.

131 DEVONSHIRE STREET, BOSTON, MASS.

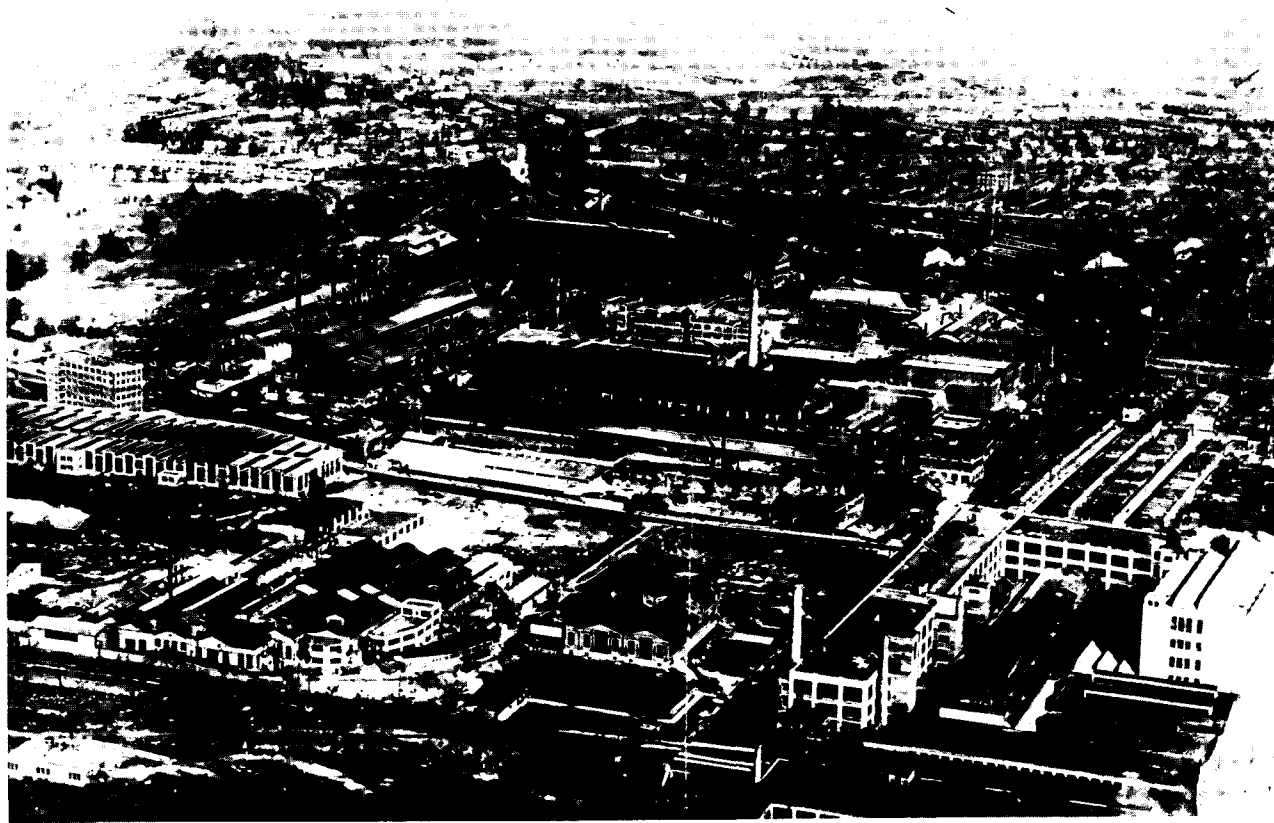


PLATE 8

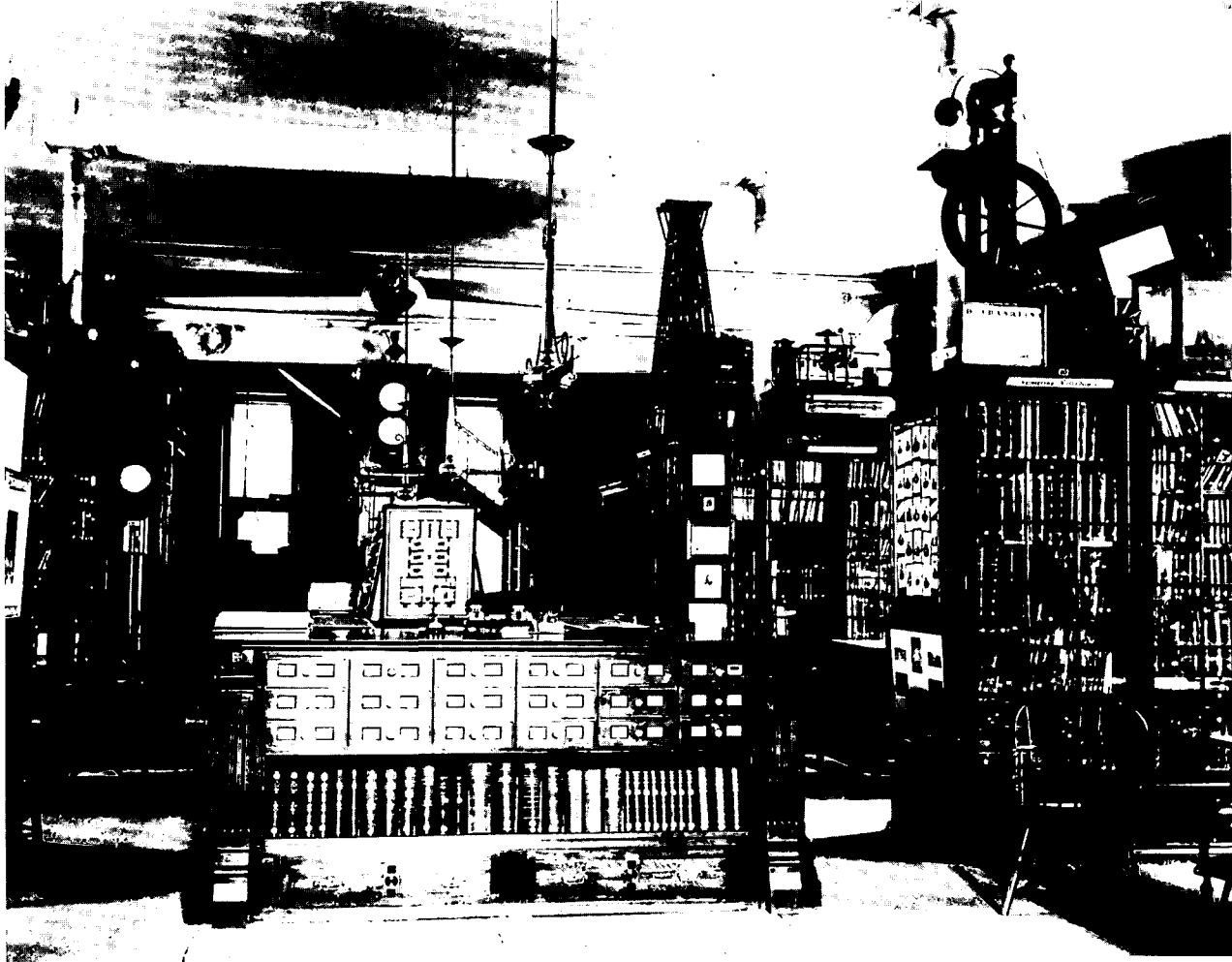


PLATE 9

BIBLIOGRAPHY OF DOCUMENTS

MANUSCRIPT MATERIALS

Membership Account Books

The Franklin Institute was organized to promote the "mechanic" culture by bringing together the worlds of the practitioners, academics, and the public in four ways:

- (a) lectures on scientific and technological developments,
- (b) research projects,
- (c) trade exhibitions, and
- (d) education.

The membership, therefore, represented a diverse range of interests and social classes.

Though the overwhelming majority of members were men, some Philadelphia women were not content to attend lectures as the guest of gentlemen members, and became members in their own right. Elizabeth Skinner, a teacher, became the Institute's first woman member in

1833 at the recommendation of Edward Poole (1). The best source for information on the activities of women in the Institute's archives is the exhibition materials (2). Women were exhibitors and judges in traditional female areas, such as needlecraft and clothing, but occasionally exhibited in other craft and industrial areas.

The Institute's Membership Account Books 1824 to 1900 are divided into groups by years. Within each group, names are ordered by first initial of surname. Entries show occupation, address, and dues paid. Resignations and Life Memberships are noted under the dues column. Deaths are noted. Blank pages occasionally separate alphabetical sections of the listings. If members' names were too numerous to fit on the pages reserved for a particular letter, they are continued after the entries for the letter Z, for example fiche 4-E-1.

- (1) Minutes of Board of Managers, Nov. 14, 1833. Membership Account Book, v. 2.
- (2) See Stephanie A. Morris, "The Franklin Institute: Women and Technology," *Signs* 4:1 (Autumn 1978), pp. 173-174.

1-A-2 to 23-A-1

Bibliography of Documents

1-A-2 to 23-A-1

FRANKLIN INSTITUTE MEMBERSHIP ACCOUNT BOOKS, 1824-1900

1-A-2: Membership Records, Volume 1, 1824 to 1831

3-A-1: Membership Records, Volume 2, 1831 to 1839

5-A-1: Membership Records, Volume 3, 1839 to 1847

7-A-1: Membership Records, Volume 4, 1848 to 1871

10-A-1: Membership Records, Volume 5, 1872 to 1880

17-A-1: Membership Records, Volume 6, 1880 to 1890

23-A-1: Membership Records, Volume 7, 1890 to 1900

44-A-1: Sept. 16, 1852 to Feb. 16, 1854

45-A-1: Feb. 16, 1854 to Jan. 17, 1856

46-A-1: Jan. 17, 1856 to Dec. 18, 1856

47-A-1: Jan. 15, 1857 to Dec. 16, 1858

48-A-1: Jan. 20, 1859 to Dec. 20, 1860

49-A-1: Dec. 20, 1860 to July 17, 1862
[Constitution amendments, May 16 to June 20, 1861, 49-B-2 to 49-B-10.]

50-A-1: July 17, 1862 to Mar. 17, 1864
[Amendment to charter, 50-E-5.]

51-A-1: Mar. 17, 1864 to May 16, 1866

52-A-1: June 26, 1866 to May 18, 1870

53-A-1: June 15, 1870 to Apr. 16, 1873
[Notes on amendment of by-laws, 1864, 1868, 1869 to 1872, 53-D-12.]

54-A-1: Apr. 16, 1873 to May 21, 1873

55-A-1: June 18, 1873 to June 17, 1874
[Exhibition of The Franklin Institute: Address of the Board of Managers and rules, 1874, 55-E-3.]

56-A-1: June 17, 1874 to Apr. 21, 1875

57-A-1: Apr. 21, 1875 to Sept. 20, 1876

58-A-1: Sept. 20, 1876 to Feb. 20, 1878

59-A-1: Feb. 20, 1878 to Jan. 21, 1880

60-A-1: Jan. 21, 1880 to Feb. 15, 1882

61-A-1: Feb. 15, 1882 to Sept. 19, 1883
[Report of the Joint Committee of Meetings and Publications on the reading of papers before the Institute, 62-E-10. Printed item, pasted in. Throughout the remainder of these records numerous printed items have been pasted into the book. These include texts of annual reports of the Board of Managers and administrative and organizational materials.]

62-A-1: Sept. 19, 1883 to May 20, 1885
[Obituary of Robert E. Rogers, Oct. 1885, 62-C-12. Enhanced image for 62-A-12 may be found on Card 530 of the microfiche file.]

Minutes of meetings

34-A-1 to 80-A-1

MINUTES OF MEETINGS OF THE FRANKLIN INSTITUTE, 1824-1925

34-A-1: Apr. 15, 1824 to Aug. 26, 1830

35-A-1: Aug. 26, 1830 to Apr. 17, 1834

36-A-1: Apr. 17, 1834 to Jan. 16, 1840

37-A-1: Jan. 16, 1840 to Mar. 18, 1843

38-A-1: Mar. 18, 1843 to Mar. 21, 1844

38-C-11: Questions proposed for discussion, Apr. 23, 1829 to July 25, 1830

39-A-1: Apr. 18, 1844 to June 18, 1846

40-A-1: June 18, 1846 to Feb. 17, 1848

41-A-1: Feb. 17, 1848 to Nov. 15, 1849

42-A-1: Nov. 15, 1849 to Feb. 20, 1851

43-A-1: Feb. 20, 1851 to Sept. 16, 1852

- 63-A-1:** June 17, 1885 to June 16, 1886
- 64-A-1:** Sept. 15, 1886 to May 18, 1887
[Charter of The Franklin Institute, 1887, 64-C-6.]
- 65-A-1:** May 18, 1887 to Mar. 20, 1889
- 66-A-1:** Apr. 17, 1889 to Jan. 21, 1891
- 67-A-1:** Jan. 21, 1891 to Feb. 15, 1893
[Enhanced images for 67-E-10 and 67-E-11 may be found on Card 530 of the microfiche file.]
- 68-A-1:** Feb. 15 to Dec. 20, 1893
[Enhanced image for 68-A-1 may be found on Card 530 of the microfiche file.]
- 69-A-1:** Dec. 20, 1893 to Oct. 16, 1895
- 70-A-1:** Nov. 20, 1895 to May 19, 1897
[Hungary Mining and Geological Millennial-Congress, invitation to attend, Feb. 1896, 70-C-2.]
- 71-A-1:** June 16, 1897 to May 17, 1899
- 72-A-1:** May 17, 1899 to May 15, 1901
[Letter of S. F. Houston, July 1900 (declines membership on Board of Managers), 72-C-7; Letters, John Birkinbine, Sept. 1900, 72-D-2.]
- 73-A-1:** May 15, 1901 to Jan. 21, 1903
- 74-A-1:** Feb. 18, 1903 to Nov. 15, 1905
- 75-A-1:** Dec. 20, 1905 to Feb. 19, 1908
- 76-A-1:** Mar. 18, 1908 to May 15, 1912
- 77-A-1:** May 15, 1912 to Feb. 21, 1917
- 78-A-1:** Feb. 21, 1917 to May 18, 1921
- 79-A-1:** Oct. 19, 1921 to Oct. 17, 1923
- 80-A-1:** Nov. 21, 1923 to Jan. 21, 1925

Sections, 1869-1923

The all-encompassing purpose of The Franklin Institute, the promotion of the "mechanic arts," took a new direction during 1869 in response to increasing specialization within the mechanic community. The Franklin Institute appointed a committee in December 1868 to study the feasibility of creating "Sections." This committee, consisting of Coleman Sellers, Henry Morton, and Pliny E. Chase, reported in March 1869 that establishment of Sections would increase membership by offering specialized forums to those with specific professional interests. In support of their view the committee cited the formation of the Conchological, Biological, and Microscopical Departments of the Academy of Natural Sciences of Philadelphia and the incorporation of the American Photographic Society as a Section of the American Institute of New York.

In April 1869 the Institute organized its first Section, the Mechanical Section. Among the founders were some of the prominent mechanical engineers of Philadelphia, William and Coleman Sellers, Washington Jones, and J. Vaughan Merrick. In 1870, three additional Sections were formed: Microscopical, Chemical, and Meteorological. It is not known whether these Sections attracted new members, but they did serve as forums for discussion of specialized topics of interest to the professional members.

During the 1870s, interest in these first Sections declined. An unsuccessful attempt was made in 1881 to form a new Mechanical Section. Dr. Isaac Morris had greater success in reorganizing the Chemical Section that year and this group remained active until 1923. In 1882, Edwin Houston and others organized the Electrical Section. Prior to 1885, a Phonetic Shorthand Section was active, promoting and teaching Pitman Shorthand in Philadelphia schools and institutions such as the Northern Home for Friendless Children and the Soldiers Orphans Institute (1).

The Electrical Section, founded in 1882 to organize the Electrical Exhibition and Conference in 1884, was superseded by an organization that grew out of the Conference's planning and activities, the American Institute of Electrical Engineers. Five of the first twelve presidents of the American Institute of Electrical Engineering were members of The Franklin Institute.

The activity of the Sections climaxed in the 1890s and early 1900s. During these years, several Sections published proceedings: Chemical (1889-1894), Electrical (1891-1893), and Naval Architecture (1893). Reports of meetings and lectures appeared in the *Journal of The Franklin Institute*. Between 1893 and 1899, members created additional Sections in Engineering and Naval Architecture (1893), Mining and Metallurgy (1897), Mechanical and Engineering (1898), Physics and Astronomy (1899), and Photography and Microscopy (1899). The last began as a branch of the Chemical Section and became independent in 1900, while the Physical and Astronomical Section became the Physical Section in 1901.

The activity of the Sections steadily declined during the early 20th century as specialized national and international scientific and technical associations came to better satisfy the needs of would-be members.

The records in this group document the activities of the Sections between 1869 and 1923, and especially during their most active period of 1869 to 1900. These records mainly consist of minutes books, lecture announcements, and correspondence. The most complete and descriptive materials are the minutes books and lecture announcements, with correspondence largely dealing with administrative matters. In addition to documenting Section activities, this record group has items relating to other agencies. The records of the Meteorological Section include documents from the Committee on Meteorology which preceded and followed the Section as well as from the Pennsylvania Weather Service that the Institute operated for the Commonwealth of Pennsylvania. The records of each Section provide more for the historian of that discipline than a list of names of Institute members interested in the meetings.

Additional information on the Sections may be found in the *Bulletin* and *Journal* of the Institute, in the minutes of the Meetings of the Board of Managers, and in the minutes of the Monthly Meetings. The Committee on Science and the Arts referred cases to the Electrical and Chemical Sections for specialized expertise. The periodicals and minutes are particularly useful in studying the Sections that were created between 1869 and 1890, but are of limited value in studying the activities of the 20th century Sections. The declining role of the Sections is reflected in the paucity of recorded 20th century activities.

1. See E. Alexander Scott, Report of Phonetic Shorthand Section, Dec. 16, 1885. Franklin Institute Archives (See also fiche 81-C-5 and 6).

81-A-2 to 82-A-10

STANDING COMMITTEE ON SECTIONAL ARRANGEMENTS

[Pages are odd-sized; they are numbered as one page per frame.]

81-A-2: Notebook [n.d., post-1870]

[Contains lists of members of Mechanical, Microscopical, Chemical and Meteorological Sections.]

81-A-9: Dec. 1, 1894 notice concerning amendment to by-laws on organization and government of Sections

81-B-2: Minutes, Dec. 1895 to Apr. 1912

81-C-2: Hector Orr, letter to Optical Section, Mar. 27, 1872, on artificial light

81-C-4: Phonetic Shorthand Section, minutes, Apr. 18, 1882

81-C-7: Phonetic Shorthand Section, report, [1885]

81-C-9: Letter to William P. Latham, President, Franklin Institute, Dec. 16, 1885 [Scott, E. Alexander]

81-D-2: Philadelphia Phonographic Society, report, [n.d.]

Handwritten text in both phonetic shorthand and cursive.

81-D-8: Philadelphia Phonographic Society, membership list, [n.d.]

81-D-10: Philadelphia Phonographic Society, draft constitution, [n.d.]

82-A-2: Section on Engineering and Naval Architecture, letter, Sept. 27, 1893 [Quinn, John F.]

82-A-4: Section on Engineering and Naval Architecture, minutes, Dec. 27, 1893

82-A-6: Section on Aerial Navigation and Aeronautics, minutes, Jan. 1912 to Jan. 1913

[Not in chronological order; for Jan. 1913 meeting see 82-A-5 with Jan. 1912 minutes following.]

82-A-10: Resolution on Aero Club of America, Jan. 25, 1912

83-A-1 to 95-G-14

CHEMICAL SECTION

83-A-1: Minutes, June 1881 to June 1909

87-B-2: By-laws

87-B-9: Membership list, 1890

87-B-14: Annual report, 1893

88-A-1: Proceedings, Volume 1: Dec. 1888 to Dec. 1889

[Index, p. iii-vii.]

[Hooker, Samuel C.; Greene, William H.; Palmer, T. Chalkey; Keller, Harry F.; Smith, Edgar F.; Frankel, Lee K.; Bullock, Charles; Paterno, E.; Norris, G. L.]

89-F-1: Proceedings, Volume 2: Jan. 1890 to Dec. 1890

[Index, p. iii-x.]

[Smith, Edgar F.; Frankel, Lee K.; MacFarlane, William W.; Clarkson, Philip S.; Keiser, Edward H.; Hooker, Samuel C.; Wahl, William; Keller, Harry F.; Haines, Reuben; Seal, Alfred N.; Greene, William H.; von Strombeck, Hans]

91-B-8: Proceedings, Volume 3: Jan. 1891 to Dec. 1891

[Index, p. iii-xi.]

[Frankel, Lee K.; Koenig, George A.; Smith, Edgar F.; Haines, Reuben; Bartram, George H.; Pemberton, Henry, Jr.; Richards, Joseph W.; Carbuit, John; Ives, F. E.; Mason, William P.; Whitehead, Cabell; Terne, Bruno; Hough, Oliver]

93-B-4: Proceedings, Volume 4: Jan. 1892 to Dec. 1892

[Index, p. iii-xi.]

[Boyer, Charles S.; Terne, Bruno; von Strombeck, Hans; Trimble, Henry; Whitehead, Cabell; Carter, Oscar C. S.]

94-C-8: Proceedings, Volume 5: Jan. 1893 to Dec. 1893

[Index, p. iii-iv.]

[Greene, William H.; Wahl, William; Breed, Mary B.; Smith, Edgar F.; Oberholtzer, Vickers; Lenher, Victor; Frankel, Lee K.; Terne, Bruno; Carter, Oscar C. S.; Pemberton, Henry, Jr.; Mailliau, Ernest; Maas, Phillip; Kebler, Lyman F.; Williams, W. J.]

95-G-14: Proceedings, Volume 6: Jan. 1894 to Dec. 1894

[Mahon, R. W.; Haines, Reuben; Pemberton, Henry, Jr.; Day, William C.; Bryant, A. P.; Keller, Harry F.; Carter, Oscar C. S.; Kebler, Lyman F.; Richards, Joseph W.; Keiser, Edward H.; Breed, Mary B.]

97-A-2 to 100-C-1

COMMITTEE ON METEOROLOGY

97-A-2: Correspondence, 1830 to June 1869

[Not in chronological order, June 1869 letter on 97-A-6.]

97-C-2: Report, 1840

Resolution on continuance of observations for the county.

97-C-5: Report, [n.d.]

97-C-6: Report, Sept. 20, 1842

97-D-1: Observations of weather conditions

98-B-1: Joseph Henry letters, Nov. 8, 9, 21, and Dec. 6, 1859

98-C-1: Reports on organization, 1870-1876

[Enhanced images for 98-C-4, 98-C-5, and 98-C-8 may be found on Card 530 of the microfiche file.]

98-E-1: Correspondence, June 1871 to Mar. 1898

[Not in chronological order, June 1871 letter on 98-E-9, Mar. 1898 letter on 99-A-4. Enhanced images for 98-E-8, 98-E-9, and 98-E-14 may be found on Card 531 of the microfiche file.]

99-C-3: Lectures: "Nimbus or storm clouds," Prof. Wise, Apr. 1, 1872

99-C-9: Lectures: "Ozone," Ernest Turner, Apr. 2, 1873, with observations

99-D-8

Bibliography of Documents

99-D-8: Pennsylvania State Weather Service forms

99-D-9: New Jersey State Weather Service forms

99-D-10: Kansas State Weather Service forms

99-E-1: Letter to county agricultural societies, 1887

[Pennsylvania State Weather Service]

99-E-2: Letter from Signal Office, War Dept, 1888

[Pennsylvania State Weather Service]

99-E-3: Legislation continuing Pennsylvania State Weather Service, 1891

99-E-5: Letter from Weather Bureau, USDA, 1892

[Weather Bureau]

99-E-7: Legislation continuing Pennsylvania State Weather Service, 1893

99-E-10: Pennsylvania State Weather Service monthly weather review, June, 1891

[Enhanced image for 100-A-4 may be found on Card 531 of the microfiche file.]

100-B-1: Letter book, Dec. 1859 to Apr. 1864

100-C-1: Minutes, Dec. 1870 to June 1897

[Enhanced images for 100-D-12 through 100-D-14, and 100-E-9 and 100-E-10 may be found on Card 531 of the microfiche file.]

101-E-4 to 111-F-6

ELECTRICAL SECTION

101-E-4: By-laws

102-A-9: Schedule of lectures, 1893 to 1894

102-A-11: Annual report, 1885

102-B-3: Annual report, 1886

102-B-8: Annual report, 1887

102-C-1: On Walter's Underground Conduit for Electrical Wires, 1885

[Enhanced images for 102-C-2, 102-C-3, and 102-C-4 may be found on Card 531 of the microfiche file.]

102-C-8: On Phelps Induction Telegraph, 1885

[Enhanced images of 102-C-8 through 102-C-13 may be found on Card 532 of the microfiche file.]

102-C-14: Notes on Telegraphy, 1886

[Enhanced images of 102-C-14, 102-D-1, and 102-D-2 may be found on Card 532 of the microfiche file.]

102-D-3: On the wiring of The Franklin Institute building, 1891

102-E-2: Letter, Mendenhall to Owens, May 29, 1914

[Office of the Coast and Geodesic Survey]

102-E-10: Legal Units of Electric Measure in the U.S., 1894

[Office of the Coast and Geodesic Survey]

102-E-14: Letter, Mendenhall to Owens, May 29, 1914

[Origin of the definition of ohm.]

103-A-1: Original report on the definition of the ohm, 1892

[Enhanced images of 103-A-1 through 103-A-3 may be found on Card 532 of the microfiche file.]

103-A-4: Letter, Pres. Grover Cleveland's private secretary to Mendenhall, July 12, 1894

[Enhanced images of 103-A-5 and 103-A-6 may be found on Card 532 of the microfiche file.]

[Thurberg, Henry; Cleveland, Grover, Pres.]

103-A-7: List of members, [n.d.]

[Enhanced images of 103-A-7 and 103-A-8 may be found on Card 532 of the microfiche file.]

103-A-12: Letterpress book, Jan. 1885 to June 1897

[Enhanced image of 104-G-2 may be found on Card 532 and 105-B-2 may be found on Card 533 of the microfiche file.]

105-D-2: Proceedings, Vol. 1: Jan. to Dec. 1891

[Pike, Clayton W.; Davis, Richard W.; Rondinella, L. F.; Hering, Carl; Hoskin, John; Brooks, David; Crew, Henry; Houston, Edwin J.; Jennings, W. N.; Bartol, Henry W.; Aldrich, William S.]

106-D-2: Proceedings, Vol. 2: Jan. to Dec. 1892

[Index, p. xi.]

[Houston, Edwin J.; Aldrich, William S.; Willyoung, Elmer G.; Pike, Clayton W.; Bedell, C. H.; Hering, Carl; Winand, Paul A. N.; Gernung, Nelson H.; Louis, O. T.]

108-G-2: Proceedings, Vol. 3: Jan. to Dec. 1893

[Title page filmed twice; Index, p. ii, plate.]

[Northrup, E. F.; Stradling, George F.; Lloyd, Herbert; Spencer, Thomas; Hering, Carl; Houston, Edwin J.; Carhart, Henry S.; Thomson, Elihu]

110-B-6: Course of Lectures, 1893-94

110-C-2: By-laws

110-C-14: Minutes, Apr. 1882 to Oct. 1888

111-F-6: Announcement of last meeting, Oct. 16, 1888

112-A-1 to 112-D-4

MINING AND METALLURGICAL SECTION

112-A-1: Correspondence, 1896 to 1897

[Enhanced images for 112-A-3 through 112-A-6, and 112-C-1 through 112-C-5 may be found on Card 533 of the microfiche file.]

112-D-2: Application for formation, Apr. 9, 1987

Membership list, [n.d.]

112-D-4: Minutes, Apr. 1897 to Feb. 1923

[Enhanced images of 113-A-6 through 113-A-8, 113-A-10, 113-A-13, and 113-A-14 may be found on Card 533 of the microfiche file.]

115-A-1 to 115-A-6

MECHANICAL AND ENGINEERING SECTION

115-A-1: Rules

115-A-6: Minutes, Dec. 1898 to Feb. 1923

117-A-2 to 117-B-3

PHYSICAL AND ASTRONOMICAL SECTION

117-A-2: Membership list, [n.d.]

117-A-10: By-laws

117-B-2: Application for formation

117-B-3: Minutes, May 1899 to May 1905
[For name change to Physical Section see 117-C-1.]

118-A-1 to 118-B-6

PHOTOGRAPHICAL AND MICROSCOPICAL SECTION

118-A-1: Brief notes on the early history of photography in Philadelphia
[Rigling, Alfred]

118-A-8: Rules

118-B-2: Notice on inheritance of photographic equipment by the Chemical Section, Feb. 13, 1899

118-B-6: Minutes, Apr. 1899 to Oct. 1919

120-A-1

PHYSICAL AND CHEMICAL SECTION

120-A-1: Minutes, Oct. 1909 to Nov. 1923

Committee on Instruction

The Committee on Lectures (1824-1825) was responsible for organizing the nightly lectures given by the Institute professors and volunteer lecturers. These popular and well attended lectures covered a broad range of topics in the areas of natural philosophy and medicine. In 1824 four chairs were established: Chemistry and Mineralogy, both held by William H. Keating who held the same posts at the University of Pennsylvania; Architecture, held by William Strickland who took students into his office as part of his professional practice; and Natural

Philosophy, held by Dr. Robert M. Patterson who occupied the same chair at the University of Pennsylvania. In 1825 Dr. John D. Godman, physician and naturalist, taught Natural History at the Institute. Members could purchase tickets for ladies to attend Dr. Godman's lectures. A mechanical drawing school, open to members, their sons and apprentices, opened in 1824, under the direction of John Haviland, architect of the Institute's new building on Seventh Street built in 1825.

In 1826 the standing committee was reorganized as the Committee on Instruction, to consider a plan for extending the school "to embrace the different branches of an elementary education."⁽¹⁾ A controversy soon developed over the nature of the Institute's educational programs. Was the curriculum to be liberal arts oriented, a classical school, or was it to be an educational opportunity for the working class poor? ⁽²⁾ The questions raised affected the Institute's changing self-image—was it an educational organization for the public, was it a beneficial society for the working classes, a scientific society for the discussion of abstract science, or a research center? Could these functions be separated? These questions were never clearly resolved and would reappear as the Institute adapted its educational programs and the nature of its discussion meetings throughout the period. Activities were continuously modified, dropped, and reorganized as the Institute's leadership reflected and directed many of the changes in the American scientific community and within its own membership.

A classical high school was opened in 1826 conducted by Walter R. Johnson, principal of Germantown Academy and later a professor of physics and chemistry at the University of Pennsylvania, in rented space on the third floor of the Institute's new building. Johnson's school was open during the day, until 1832. From November 1831 to 1837 the Institute operated an "English School" in the evenings. The dominant figure in the Institute's educational efforts during the 1830's, was Alexander Dallas Bache. Seven time chairman of the Committee on Instruction, Bache had been assistant professor at the U.S. Military Academy and member of the Army Topographical Engineers prior to coming to Philadelphia as professor of Natural Philosophy and Chemistry at the University of Pennsylvania in 1828. In 1836

Bache became president of Girard College. Upon return from a two year trip to Europe, Bache became the first "President" (or principal) of the city's Central High School for Boys in 1839, presiding over a faculty which included several Franklin Institute professors until 1843 when he left Philadelphia to become head of the U.S. Coast Survey, and, later, first president of the National Academy of Sciences. ⁽³⁾

The bond between the Institute and Central High School persisted throughout the 19th century. Samuel Vaughan Merrick, the acknowledged founder of the Institute, enrolled his son, John Vaughan Merrick, at Central. Edwin J. Houston, Institute Manager, was on Central's faculty when Elihu Thomson was a student there (he graduated in 1870). Thomson, in an address on the observance of the centenary of the Institute's founding, recalled his early association with Central. He was elected a member of the Institute in June 1874 and was soon asked to give a course of five lectures on electricity during the season of 1876-1877. Thomson recalls that "it was quite an undertaking," especially at the age of twenty-three. At the last of these lectures in 1877 Thomson reversed a Ruhmkorff coil by sending a Leyden jar discharge through its fine wire. He attributes to this lecture his "first clue to what afterward became the art of electric welding" ⁽⁴⁾. Thomson also taught at Central High School.

Early Institute members, such as Peter A. Browne, were involved in planning a Proposed New College (1826) and a Proposed School of Arts (1838). Neither of these programs, however, received public support. A similarly unsuccessful venture was the School System of Moral and Civil Training.

In 1898 the School of Elementary Mathematics offered instruction in this subject. When it expanded to include mechanics, strength of materials, and machine design, it was renamed the School of Machine Design.

In 1899 the School of Naval Architecture opened under the direction of Professor A. J. Maclean.

In 1910 the educational programs of The Franklin Institute were revised. All of the previously existing schools were incorporated as departments of the new School of Mechanic Arts (1910-1923). That year William A. Thorne, professor of drawing since 1891, became the new director. During the First World War a course in radio communication was offered.

In 1923 the Committee on Instruction concluded that the instruction given by the School of Mechanic Arts was available elsewhere, for example, in some of the city's public schools. The School closed after the spring term.

Most of the students were young men. The only program designed for women was Mrs. Sarah Peters' School of Design for Women. This school had a brief connection with the Institute during its development between 1850-1853. In 1853 Mrs. Peters' School was chartered as the Philadelphia School of Design for Women. The Moore College of Art is, in part, an outgrowth of this school. Women appear again in the Register of Students for the 1915-1916 term with Sophie Colles and Marie Smith receiving Honorable Mention for their work in the Department of Drawing (5). In 1918 Lewis C. Robinson, director of the School, corresponded with several Philadelphia businesses concerning the "growing demand for young women to fill drafting positions" (6). The number of female names in the Register of Students soon increased.

The records of the Committee on Instruction include student enrollment, faculty correspondence, lectures, a textbook of drawing, and curricula outlines. The *Evening Course and Classes* pamphlets printed in the early 20th century reproduced some student drawings. Reports include enrollment figures, the names of graduates and honors recipients, and expenses and administrative matters.

Resignations of Faculty Members, while useful in following individual career patterns, were not filmed due to the quantity and administrative nature of the letters. Researchers interested in individual faculty members should contact the Archives office. The enrollment books give the names of students and their sponsors.

- (1) Minutes of the Board of Managers, Feb. 2, 1826.
- (2) For a discussion of the school controversy, see Bruce Sinclair, *Philadelphia's Philosopher Mechanics: A History of The Franklin Institute 1824-1825* (Baltimore: Johns Hopkins University Press, 1974), pp. 108-134.
- (3) See Bruce Sinclair, *ibid.*, pp. 149-151.
- (4) Elihu Thomson, "Address," *Journal of The Franklin Institute*, 198:5 (November 1924), pp. 585-586.
- (5) Register of Students, 1915-1916, in *Evening Courses and Classes, 1916-1917*, p. 217. These little pamphlets give faculty names, curricula, and other information.

- (6) [Robinson] to Mr. W. L. Austin, Baldwin Locomotive Works, Aug. 8, 1918 (Copy), Student Employment Correspondence, 1916-1918, fiche 137-B-7.

122-A-2 to 137-A-1

COMMITTEE ON INSTRUCTION

Minutes, Reports, Correspondence

122-A-2: Minutes, 1831

Resolutions on establishment of an English school.

122-B-4: Reports, 1824 to 1825, Committee on Lectures

123-A-1: Reports, 1826 to 1843, Committee on Instruction

124-A-1: Correspondence, 1826 to 1865 [Some letters undated.]

124-B-10: Correspondence, William F. Durfee to Coleman Sellers, July 31, 1891

Lectures

124-C-1: Walter R. Johnson, "Address on mechanics and natural philosophy," 1828

124-D-6: Walter R. Johnson, "On schools of the arts," 1835

Delivered to American Institute of Instruction at the annual meeting, Boston, 1835.

125-A-2: John K. Mitchell, "A lecture on some of the means of elevating the character of the working classes," 1834

Drawing School

126-A-2: Reports, 1886 to 1900

126-E-11: Intermediate Course in Mechanical Drawing, 1891, (textbook) [Thorne, William H.]

High School

127-A-1: Planning documents, 1826

127-E-12: Address of the Committee of Instruction on the High School Department, [n.d.]

[Includes rules of the high school. Enhanced image of 128-B-8 may be found on Card 533 of the microfiche file.]

[Patterson, Robert M.; Ronaldson, James; Merrick, Samuel V.; Ralston, Ashbel G.; Troth, Henry; Vaux, Robert; Mitchell, John K.; Smith, Daniel B.; Garrigues, Isaac B.]

129-B-2: Reports, 1826

[Enhanced images of 129-B-6 through 129-B-9 may be found on Card 534 of the microfiche file.]

School of Arts (Proposed)

129-E-2: Memorial for establishment of a school of arts to the Pennsylvania legislature by The Franklin Institute, 1837

129-E-14: Memorial for establishment of a school of arts to the Pennsylvania legislature by the city and county of Philadelphia, 1838

130-A-8: Thaddeus Stevens, Speech in favor of establishment of a school of arts, Mar. 10, 1838

SCHOOL OF MECHANIC ARTS

131-A-2: Evening courses and classes, 1910 to 1923

137-A-1: Employment references and referrals

Special Committees

The Franklin Institute, "for the promotion of the Mechanic Arts," worked directly to promote American technology. Working through its membership, the Institute initiated a number of investigations into critical areas of industrial development. One involved a traditional power—the waterwheel. In 1829 a committee was appointed by the Board of Managers to investigate the motive power of waterwheels. (1) Equipment was designed and constructed, and a temporary building was erected at Vine and Ninth Streets. Subscriptions were raised to fund this undertaking. Ideas and accounts of experiences were requested; letters, drawings, and men came to the Institute to aid the investigation or

to seek information from the Committee. Over 700 tests were conducted with breast, overshot, and undershot wheels. Tables of results were published in the *Journal of The Franklin Institute* (these tables were not reproduced on fiche). Millwrights could continue to use this traditional power source but now in a more efficient way and with a better understanding of the forces involved.

While this investigation was proceeding, a second was initiated. This looked at a new power source—steam boilers. Numerous explosions had resulted in loss of life and loss of confidence in this important invention. The Institute's Managers felt that these accidents should be avoidable and a committee was appointed to investigate. Of the whole committee seven men, William H. Keating, Alexander Dallas Bache, James P. Espy, Walter R. Johnson, Matthias W. Baldwin, Samuel Vaughan Merrick, and Benjamin Reeves, were clearly the ones most responsible for planning and conducting the investigation. The first four were men of science; the last three were industrialists. They formed what Bruce Sinclair has termed "a near perfect blend of science and practicality." (2) Keating was chairman until he resigned in 1832. Bache succeeded him and soon became the force behind the committee. As chairman of the Institute's monthly conversation meetings, Bache made boiler explosions the principal topic of discussion. When the Secretary of the Treasury wrote, suggesting cooperation in a course of experiments, it was Bache's outline of research which was adopted.

Once again equipment was designed and constructed; tests were conducted and the results published in the *Journal of The Franklin Institute*. Bache's *General Report* combined theory and practice, and drew upon an understanding of the problem by scientific men in Europe and America engaged in this work. The Report was an authoritative document, the capstone of a series of scientific and technological triumphs by a young and vigorous organization. (3)

This was not the end of Institute researches into steam boiler explosions. In 1864 a joint committee, composed of representatives of the National Academy of Sciences, The Franklin Institute, and the Navy Department, was appointed to investigate and compare the results "to be obtained by different measures of expansion of steam" (4).

The Institute also conducted experiments on another new power source—dynamo-electric machines. In 1877 the Board of Managers authorized the Committee on Instruction to purchase a machine capable of producing not less than 1200 candles' light. As wise consumers the Committee decided to do some comparative testing. Jacob B. Knight, engineer, was the chairman of the committee to test the machines. Edwin J. Houston and Elihu Thomson conducted the tests of Electric Measurement. The Report appeared in the May-June 1878 issue of the *Journal of The Franklin Institute*. (5) The conclusion followed the Electric Measurement report. This was to purchase the small Brush machine (two Brush machines, two Wallace-Farmer, and one Gramme machine had been tested). Thomson recalled this committee work as "valuable as a foundation" for his future efforts in this field (6).

One of the critical requirements for national and international industrial development is a standard set of weights and measures. In 1833 the Institute suggested that the Commonwealth of Pennsylvania refer Bill 197, in the House of Representatives, to the Institute for review. The house complied with the request and a committee of Institute members examined the bill, comparing European and American systems, and suggested amendments to the bill. These amendments were incorporated into the new legislation. This was not the end of the Institute's investigations into systems of weights and measures. In 1902 a committee headed by James Christie prepared a report recommending adoption of the metric system in the United States. Not all Institute members were in agreement. Coleman Sellers was one of those opposed. Nonetheless, the members present at the Feb. 19, 1902 meeting voted to adopt the report. Considerable debate followed in the scientific and engineering community. Some of the printed arguments for both sides are included in this collection. F. A. Halsey, in a paper distributed before the Dec. 3, 1902 meeting of the American Society of Mechanical Engineers (and published, with discussion, in its *Transactions*), asked: "Why should we go to France and Germany for our weights and measures? Shall the mountain go to Mohammed at last?" (7). Monte A. Calvert saw the debate over the metric system as a conflict between the "shop culture elite" and the "school" or academically trained engineers. This

attitude can be seen in Edwin J. Houston's support of, and William and Coleman Sellers' opposition to, the metric system's adoption (8).

The other Special Committee filmed is that on Models. The committee gathered models and mineral specimens for the Cabinet kept in the Library. In addition to its intrinsic educational value, the committee's work was one of the early forerunners of the modern Franklin Institute Science Museum.

- (1) Minutes of the Board of Managers, Mar. 12, 1829. Franklin Institute Archives.
- (2) Bruce Sinclair, *Early Research at The Franklin Institute: The Investigation into the Causes of Steam Boiler Explosions, 1830-1837* (Philadelphia by the Institute, 1966), p. 9.
- (3) The text of the report may be found beginning on fiche 150-A-4 for Part I and on 149-D-14 for Part II.
- (4) See the "Report of the Board of Examiners," 1868, for this committee's work, fiche 155-A-2.
- (5) See fiche 140-B-2.
- (6) Elihu Thomson, "Address on the Occasion of the Observation of the Centenary of the Founding of The Franklin Institute," *Journal of The Franklin Institute*, 198:5 (Nov. 1924), p. 592.
- (7) F. A. Halsey, "The Metric System," p. 37. Committee on the Metric System, 1902, see fiche 144-B-2 and 144-F-6.
- (8) Monte A. Calvert, *The Mechanical Engineer in America: 1830-1910* (Baltimore: Johns Hopkins University Press, 1967), pp. 182-183. Minutes, Feb. 19, 1902, p. 14, for Houston's support as "a scientific man," fiche 142-A-1.

138-A-2 to 139-D-9

COMMITTEE ON WEIGHTS AND MEASURES

138-A-2: Minutes, June 1833 to July 1837

138-C-1: Report on the measure of the meridian of France to the National Institute of France

138-C-8: Report on the standard Troy pound by U.S. Mint, 1883

[Moore, James]

138-E-12: Report on the standard weights and measures used in Great Britain
[British author's signature illegible]

139-C-12: Report on the standard weights and measures used in U.S.
[U.S. author not identified.]

139-D-9: Report on the standard weights and measures used in France
[French author not identified.]

140-B-2

COMMITTEE ON DYNAMO-ELECTRIC MACHINES

140-B-2: Report, 1878

Reprinted from the *Journal of The Franklin Institute*, May-June 1878

141-A-1 to 141-C-4

COMMITTEE ON MODELS

141-A-1: Catalogue of models, 1824 to 1835

141-B-2: Bond deposit receipt for mineral and geological specimens, 1848
[Committee on Minerals and Geological Specimens]

141-B-5: Reports, 1850
[Committee on Minerals and Geological Specimens]

141-B-12: Letters, 1858 and 1874
[Two items.]

141-C-4: Inventory of philosophical apparatus, [n.d.]

142-A-1 to 147-B-1

SPECIAL COMMITTEE ON THE METRIC SYSTEM

142-A-1: Minutes of The Franklin Institute, Feb. 1902

[Discussion of the report of the Special Committee on the Metric System.]

142-C-2: Form letter and responses, 1902

144-A-2: Benjamin S. Smith, Against adopting the metric system, 1897

144-B-2: F. A. Halsey, The metric system, 1902

[Presented to the American Society of Mechanical Engineers meeting Dec. 1902. Transmittal cover letter from the American Society of Mechanical Engineers of Nov. 20, 1902 on 144-C-5 between pages 17 and 18 of the paper.]

144-E-12: American Meteorological Society, The metric system of weights and measures: why it should be adopted in the U.S.

144-F-6: F. A. Halsey, The metric system, 1902

[Taken from the *Transactions* of the American Society of Mechanical Engineers, 1902, and includes additional materials and discussions from the meeting of Dec. 1902.]

147-B-1: American Society of Mechanical Engineers, Report of the committee appointed to discuss the arguments in favor of and against the metric system, 1903
[Christie, James; Miller, Fred J.; Bond, George M.; Kent, William]

148-A-4 to 155-A-2

COMMITTEE ON BOILER EXPLOSIONS

148-A-4: Minutes, June 1830 to Jan. 1831

148-D-7: Correspondence, July 1824 to Mar. 1867

[Not in chronological order, Mar. 1867 letter on 148-F-2, majority of letters from Treasury Department.]

148-F-5: Communications, 1832

[Title page appears twice. Items extracted from the *Journal of The Franklin Institute*. Includes papers of the Joint Committee appointed by the Select and Common Councils of 1817, Robert Vaux, William Smith, William Lehman, Horace Binney, and George Vaux, members. Most communications contain accounts and general ideas about explosions, those presenting technical material have been indexed.]

[Long, S. H. (Col.); Herbert, L.; Ingham, S. D.; Evans, Cadwallader]

149-D-10: General Report of the Committee, 1836

Part II. [Written by Alexander D. Bache.]

149-G-10: Bill for the regulation of the boilers and engines of vessels propelled in whole or in part by steam, 1836

[Bill in the U.S. Senate.]

150-A-4: Report of Experiments for the Treasury Department, 1836

Part I. [Written by Alexander D. Bache.]

151-A-12: Report of Experiments for the Treasury Department, 1837

Part II. [Containing the report of the subcommittee for the examination of the strength of materials. Written by Walter R. Johnson.]

154-A-1: Report of the Committee on Factors of Safety for Carrying Steam Pressures, [n.d.]

[Briggs, Robert; LeVan, W. Barnet; Durfee, William F.; Schutre, L.]

155-A-2: Report of "the Board of Engineers" to the Secretary of the Navy on the Boilers of the USS *San Jacinto*, 1868

[Isherwood, B. F.; Everett, W. E.; Coryell, Miers; Bromley, William; Copeland, Charles W.; Bartol, B. H.; Merrick, J. Vaughn; Hibbard, William C.; Wright, William]

156-A-1 to 157-D-10

WATERWHEEL INVESTIGATIONS

156-A-1: Minute Book of the Committee, Mar. 1829 to Nov. 1830

156-C-12: *Queries and answers*, July 1830

156-D-3: Report, Dec. 1829

156-D-5: William H. Hamilton, Actuary, Subscription Book

157-A-2: Estimates of costs for building machinery

157-A-4: Sketch of Birkinbine's hydraulic ram

157-A-5: Joseph C. Strode, "Plan for calculating the curve for driving pipe of a ram, and by which that at Girard College was calculated," Jan. 1848

157-A-7: Statement of receipts and expenditures, Mar. 10, 1831

157-A-11: *Reports with drawings of waterwheels*, [ca. 1830]

[Brown, James M.; Lawber, John C.]

157-D-5: Announcement of establishment of committee with some subscriptions

157-D-7: Announcement of establishment of committee

157-D-10: *Correspondence*, Sept. 1825 to Nov. 1866

Correspondence

Three series of Correspondence were filmed: Incoming Correspondence, 1824-1859; Corresponding Secretary's Letterbook, 1824-1826; and *Other Mechanics' Institutes*, 1824-1915. Correspondence of a more strictly administrative nature, such as resignations of members, was not filmed because of the narrow usefulness of the material in comparison to its bulk. For similar reasons, incoming correspondence after 1859 was not filmed. By then the Sections and the relevant Committees were receiving the more substantive inquiries. The secretary, or actuary, mostly received requests for membership information or *Journal* information and exchanges.

Incoming Correspondence is primarily chronological, with letters alphabetically arranged within years. A few letters or forms are out of sequence but, by and large, the arrangement is a simple one. Contained in this selection are inquiries concerning Institute activities, letters of introduction, correspondence regarding the *Journal of The Franklin Institute* including acknowledgments of receipt from several foreign scientific societies, printed materials describing patented inventions and advertising of new products, and requests for information on particular manufacturing processes.

The Corresponding Secretary's Letterbook has an "Index" in the front of the volume. It is not an exact alphabetical index but is helpful in finding people within the volume. Occasionally an address or speech was forwarded with a letter and a few are tipped in. For example, Benjamin Hewood's "Address to the Mechanics, Artisans, etc., Delivered at the Opening of the Manchester Mechanics Institute," Mar. 30, 1825, begins on p. 109 found at fiche 199-E-10 (handwritten transcription). The "Index" refers to "An Address by the Chairman of the Manchester Mechanics' Institute, p. 109." The First Annual Report of The Franklin Institute (a newspaper clipping) is tipped in on p. 133 at fiche 200-B-6. Peter A. Browne's "Address to the Freemen of Pennsylvania," June 2, 1825 (a newspaper clipping, on education) is tipped beginning at fiche 199-D-14, and another address, June 8, 1825, beginning on fiche 199-E-1.

Correspondence with Other Mechanics' Institutes deals with exhibitions and exchanges of delegates between "kindred societies." The Franklin Institute was considered a model for newer institutes and was frequently asked for copies of its constitution as guides. One unique series of letters deals with the Paris Inventors Academy, 1893-1894. This was a scheme to obtain an entrance fee from inventors for a Diploma and Medal awarded by the Academy at its "recent" exhibition. Only the Academy never existed. Another interesting series of letters is concerned with encroachment on The Franklin Institute name by a correspondence school in Rochester, N. Y.

160-A-1 to 193-C-1

INCOMING CORRESPONDENCE, 1824-1859

- 160-A-1:** 1832 incoming correspondence
- 160-B-12:** 1833 incoming correspondence [India Rubber Society]
- 161-A-1:** 1824 incoming correspondence
- 161-A-3:** 1825 incoming correspondence
- 161-A-4:** 1826 incoming correspondence
- 161-A-7:** 1828 incoming correspondence
Letter beginning on 161-A-11 in French.
- 161-B-3:** 1829 incoming correspondence
- 161-D-1:** 1830 incoming correspondence
[Letters not in chronological order. Enhanced images of 161-D-7 and 161-D-8 may be found on Card 534 of the microfiche file.]
- 161-E-3:** 1831 incoming correspondence
[Letters not in chronological order.]
- 162-A-11:** 1832 incoming correspondence
[Letters not in chronological order.]
- 163-A-1:** 1833 incoming correspondence
- 163-B-3:** 1834 incoming correspondence
[Letter beginning on 163-C-7 includes drawing of railroad track device. Letters not in chronological order.]
- 164-A-1:** 1835 incoming correspondence
[Rows 163-C and 163-D are duplicates. Letters not in chronological order.]
[Williams, J. S.]
- 165-A-12:** 1839 incoming correspondence
- 165-C-9:** 1836 incoming correspondence
[Maryland Academy of Science and Literature]
- 166-C-4:** 1837 incoming correspondence
[Electro-Magnetic Association; Massachusetts Charitable Mechanics Association]
- 166-C-12:** 1838 incoming correspondence
[Societe Polytechnique (pratique); Pennington, John H.]
- 167-E-6:** 1840 incoming correspondence
[Petition for patent law revision regarding ornamental design changes on 168-C-5.]
- 168-E-8:** 1841 incoming correspondence
- 170-A-2:** 1842 incoming correspondence
[Several notices of proceedings before bankruptcy court.]
- 171-A-5:** 1843 incoming correspondence
[Union Agriculturist Society; American Philo-sophical Society; London Provident Institution; National Institute]
- 172-B-1:** 1844 incoming correspondence

[Casselberry, Evans]

173-C-8: 1845 incoming correspondence
 [Enhanced images of 173-D-10 through 173-E-5, and 174-E-2 through 174-E-6 may be found on Card 534 of the microfiche file.]
 [National Magazine and Industrial Record; Nicolls, G. A.; Roebling, John A.]

175-B-5: 1846 incoming correspondence

177-B-1: 1847 incoming correspondence
 [Leeds Mechanics Institution and Literary Society]

178-D-6: 1848 incoming correspondence
 [Smithsonian Institution]

180-E-1: 1849 incoming correspondence
 [American Association for the Advancement of Science; Patent Office]

183-A-1: 1850 incoming correspondence
 [Enhanced image of 183-E-14 may be found on Card 534 of the microfiche file.]
 [Ecole Nationale des Mines]

185-A-1: 1851 incoming correspondence
 [Patent Office]

187-B-3: 1852 incoming correspondence

189-E-3: 1853 incoming correspondence
 [Mitchell, D. M.]

192-B-1: 1854 incoming correspondence
 [Ballewell, Thomas]

192-E-1: 1856 incoming correspondence

193-B-1: 1857 letter

193-B-2: 1858 incoming correspondence

193-C-1: 1859 incoming correspondence

198-A-1 to 200-C-5
CORRESPONDING SECRETARY'S
LETTERBOOK, 1824-1826

[Peter A. Browne, Secretary]

198-A-1: Alphabetical Index
 [Sorted by initial, by date]

198-B-14: Letters, 1824

198-C-8: Letters, 1825

198-C-14: Newspaper clipping on formation and activities of The Franklin Institute, Dec. 1824

199-D-14: Peter A. Brown, Address to the freemen of Pennsylvania, June 1825

199-E-3: Peter A. Brown, Address on laying the corner stone of the hall, June 1825

199-E-10: Benjamin Hewood, Address to the mechanics, artisans, etc. Manchester, Mar. 1825
 [Transcription.]

200-B-6: Annual report, 1825
 [Newspaper clipping. Enhanced image of 200-B-6 may be found on Card 535 of the microfiche file.]

200-C-5: Letters, 1826

201-A-1 to 207-A-10
CORRESPONDENCE FROM OTHER
MECHANICS INSTITUTES

201-A-1: American Institute of New York (correspondence, 1829 to 1859)

202-B-1: New York Mechanic and Scientific Institution (charter and by-laws; correspondence, 1831 to 1852)

203-A-1: Brooklyn Institute (notice of formation, 1843; article, 1898)
 [Ferree, Barr]

203-C-2: Maryland Institute for the Promotion of the Mechanic Arts, 1857 (tenth exhibition notice, 1857)

203-C-4: Franklin Institute of Rochester, N.Y. (Schedule of examinations and promotional materials, correspondence, 1909-1910)
 [Dispute over use of Franklin Institute name.]

204-B-1: Franklin Institute of New Haven (outline of structure, goals [ca. 1840])

204-C-1: Paris Academy of Inventors (correspondence and information, 1893-1894)

205-A-1: New York Electrical Society (constitution, by-laws, and membership, 1912-1913)

205-B-13: Association for the Exhibition of the Industry of all Nations (notice for exhibitors, 1853)

205-C-1: Maclurian Lyceum of Arts and Sciences (report of transactions, 1830)

205-D-1: Pittsburgh Institute of Arts and Sciences (correspondence, 1836)

205-D-2: Pittsburgh Mechanics Institute (letter, 1830)

205-D-5: St. Mark's Workingmen's Club and Institute (advertising, [n.d.])

205-D-10: Society for Development of Mineral Resources of the U.S. (announcement of formation, 1848)

205-D-11: Fulton Institute (exhibition announcement; correspondence, 1859) [Lancaster PA]

205-E-3: Pittsburgh Institute of Arts and Sciences (correspondence, 1839)

205-E-5: Pittsburgh Mechanics Institute (constitution and officers; correspondence, n.d.)

205-E-13: Ohio Mechanics Institute (correspondence, 1834, 1839; exhibition notice, 1854 and 1857)

206-A-9: Richmond Athenaeum (correspondence, 1830 and 1831)

206-A-14: Virginia Mechanics Institute (exhibition notice, 1854)

206-B-4: Wheeling Mechanics Institute (correspondence, 1834)

206-B-6: Metropolitan Mechanics Institute (correspondence 1852; exhibition notices, 1852) [Washington D.C.]

206-C-12: Kentucky Mechanics Institute (exhibition notices, 1854, 1855, and 1856; correspondence, 1856 and 1859)

206-D-12: Maryland Institute (exhibition notice, 1850, 1853 to 1856; correspondence, 1847, 1848, 1852, 1853, 1857, 1859; constitution, 1847)

207-A-10: Massachusetts Charitable Mechanics Association (correspondence, 1837, 1840, 1844, 1859; exhibition notices, 1839, 1841, 1844, 1847, 1853)

Exhibitions

THE COMMITTEE ON PREMIUMS AND EXHIBITIONS, 1824-1874

The Committee on Premiums and Exhibitions was administratively responsible for the elaborate displays of American products presented by The Franklin Institute. One of the six standing committees appointed in 1824, it continued to function throughout the 19th century. The Institute conducted thirty exhibitions between 1824 and 1899. Twenty-six of these exhibitions were of domestic manufactures (1824-1858), and one was for the fiftieth anniversary of the Institute (1874). The next was the International Electrical Exhibition (1884). This was followed by the "Novelties" Exhibition (1885). The final exhibition was co-sponsored with the Philadelphia Commercial Museum; this was the National Export Exposition (1899).

Although the exhibitions grew in size and changed somewhat in procedure and purpose, the general format and, therefore, the types of records, remained consistent. There were four major types of records for each exhibition:

- (a) Committee on Premiums and Exhibitions and subcommittees: reports, minutes, correspondence, addresses and announcements.
- (b) Exhibitors: invoices, correspondence, advertisements, and catalog.
- (c) Judges and Awards: reports, correspondence, and medals.
- (d) Exhibition: announcements, tickets, financial records, and attendance.

The standing committee appointed subcommittees to handle publicity, to inform potential exhibitors and visitors, to arrange for the building

and to secure power and other practical considerations such as insurance and refreshments. Since all this work was voluntary, individuals solicited as committee members could decline. Correspondence with individuals requested to act as judges indicate that some declined and others—not Institute members—were puzzled by the notice.(1)

The subcommittees held their own meetings and reported periodically to the standing committee which reported to the Board of Managers. The chairman of the committee presented an address at the close of the exhibition which included abstracts of all the judges' reports for that exhibition. This combined report and the catalog provide most of the information about the exhibits; the report included attendance figures and a brief description of the planning and conduct of the exhibition.

The exhibitors' records include invoices of the individual exhibitors and requests for the return of the exhibited items. Very few of the exhibitors during the first period of exhibitions (1824-1858) sent advertisements. Advertisements are primarily 1884 and 1885 records. As not all exhibitors received awards, the source of information on the complete group is the manuscript catalog. This differs from the published account in the *Journal of The Franklin Institute* in that it generally includes the names of the depositors. Merchants frequently deposited items which they sold or which were made by others in their company; the manuscript catalog mentions these differences. It also contains notices of items sold during the exhibition, a practice which saved freight costs and stimulated additional trade.

One of the major purposes of the exhibitions was the awarding of medals for excellence of workmanship and for novelty in design. The Subcommittee on Arrangement drew up the classes of exhibits (17 classes in 1824, 30 in 1825) and appointed committees to inform potential exhibitors and to suggest judges for each class. The judges were men and women from the scientific, technological, and entrepreneurial communities, selected for their recognized knowledge and experience. Each committee examined the exhibits prior to the exhibition's opening and recommended awards in the form of medals or certificates of honorable mention.

Judges could not receive an award in the class for which they were appointed. This rule ensured impartiality but it sometimes made finding qualified judges a problem. Other difficulties surrounded the awards system. Many announced premiums were unclaimed. In 1828 forty-five premiums were announced but only nine were awarded; in 1833 only twenty-six of the 105 announced premiums were awarded (2). In 1838 the announcement of the tenth exhibition did not include a list of premiums. This "more liberal course" admitted into competition "all articles of American manufacture" of special merit. (3) Thirty-one silver medals and 123 certificates were awarded that year.

In 1843 the Committee's name was shortened to the Committee on Exhibitions. The draft of the May 18, 1843 Address show the words "Premiums and" crossed out. Awards were still made during the exhibition but another standing committee, that on Science and the Arts, shared the responsibility for recognizing excellence and merit. *Subcommittees of the Committee on Science and the Arts met throughout the year and examined inventions and innovations in many aspects of technology. The Committee on Exhibitions frequently referred disputes over medals to the Committee on Science and the Arts for a more extensive investigation.* (4)

The reports of the judges describe the exemplary nature of the award-winning exhibits and occasionally reveal attitudes which extend beyond the strictly technological realm, for instance the role of children. Children were an important part of exhibitions; special days and times were set aside for groups of school aged children to be taken on tours of the exhibits. In 1853 Girard College students visited the exhibition. The secretary of the faculty thanked The Franklin Institute for the opportunity which would be "of great service" to the pupils "in after life by raising within their minds a spirit of emulation and a desire to excel in the various mechanical and useful arts."(5)

Work done by children received special mention from the judges. A wooden tub made by a ten-year-old boy promised "much for the young mechanic." In 1825 a group of orphans received special mention for their work and the judges commended "the praiseworthy exertions of the managers of this truly charitable establishment, in rendering the children...of use to society, by bringing them up to habits of

Industry." (6) The judges were Robert E. Griffin, M.D., and Edward Poole, school teacher. In the manuscript catalog the judges list the items, Nos. 615-629, exhibited by the children. These included two pincushions, a cover for a work table, and a watch case. The judges here recommended "an honorary mention...for the remarkably neat and well furnished condition of all the articles presented." The deposit record notes the prices for which some items sold, the pincushion sold for fifty cents.(7)

Abstracts of the judges' reports are part of each of the final reports of the Chairman of the Committee on Exhibitions. For each exhibition, 1824-1858, any early announcement of premiums (until 1833), the chairman's report, committee minutes, and any addresses (after 1842) were filmed.

For the first exhibition, 1824, all the records were filmed to indicate the patterns to be found in the materials. For subsequent exhibitions filming was more selective. Catalogs were filmed. Special Reports such as those on sewing machines (1858) and steam boilers (1874) were filmed because of their unique nature. Additional materials, such as the series Resignations: Committee on Exhibitions, were not filmed due to the largely administrative nature of the content. Items or series selected for filming tend to have a usefulness that extends beyond the in-house record-keeping origin of the materials.

Exhibition records provide a spectrum of mechanics, craftsmen, and industrialists, from that ten-year old boy to John Haviland, architect and the Institute's professor of drawing, and Thomas Sully, painter. The rhetoric of the announcements echoes similar statements of other mechanics' institutes.(8) The increasing complexity of the exhibits reflected the growing diversity of the American technological community.

One of the hardest problems to be solved each year was finding a hall large enough to accommodate the increasing number of exhibits. The first hall used was Carpenters' Hall; by 1874 an old Pennsylvania Railroad depot was needed. This difficulty was one of the reasons the general exhibitions ceased to be annual and a cause for their cessation in 1858.

(1) Judges' committees' correspondence and resignations were not filmed. Contact Franklin Institute Archives for these records.

(2) See Committee on Premiums and Exhibitions, Oct. 1828 and other years for the small number of announced premiums being claimed. The list was circulated in the spring, several months before the exhibitions held to coincide with the fall quarterly meeting.

(3) Address, Committee on Exhibitions, 1838.

(4) Address, Committee on Exhibitions, 1843. See A. Michal McMahon and Stephanie A. Morris, *Technology in Industrial America: The Committee on Science and the Arts of The Franklin Institute 1824-1900* (Wilmington: Scholarly Resources, Inc., 1977) for a calendar of Committee on Science and Arts subcommittee reports. See Committee on Science and Arts No. 523 (1849) and Committee on Science and Arts No. 936 (1874) for cases referred to Committee on Science and Arts by the Committee on Exhibitions (pp. 67 and 117).

(5) George I. Becker to Committee on Exhibitions, Nov. 2, 1853. Committee on Exhibitions correspondence, 1853.

(6) Committee on Cabinetware, John Haviland, chairman, 1824. Judges' Reports (Class 28-Fancy Articles), in Committee on Exhibitions report, 1825, p. 12.

(7) Class 28, Fancy Articles, Manuscript Catalog. Membership Account Book, Volume B, shows Poole to be a member from 1831 to 1835, not in 1825. Account book gives his occupation as teacher.

(8) For other institutes' announcements, see Other Mechanics' Institutes Correspondence in this collection starting on fiche 201.

208-A-1 to 250-A-2

COMMITTEE ON PREMIUMS AND EXHIBITIONS

UNPRINTED RECORDS

208-A-1: Committee on Premiums and Exhibitions, minutes, Oct. 21, 1824 to Oct. 14, 1825

208-D-2: Committee on Arrangements, minutes, Mar. 2 to Oct. 14, 1825

208-E-3: Committee on Premiums and Exhibitions, minutes, Feb. 2, 1827 to Sept. 20, 1830

209-B-4: Committee on Premiums and Exhibitions, minutes, Oct. 13, 1830 to Oct. 26, 1831

209-E-3: Committee on Premiums and Exhibitions, minutes, Nov. 2, 1831 to Sept. 23, 1833

209-G-14: Committee on Premiums and Exhibitions, minutes, Oct. 9, 1833 to Sept. 29, 1835

210-D-2: Committee on Premiums and Exhibitions, minutes, Nov. 3, 1835 to Mar. 14, 1836

210-D-10: Committee on Arrangements, minutes, June 2, 1826 to Sept. 20, 1842

214-A-1: Committee on Arrangements, membership lists, 1843

214-A-3: Committee on Arrangements, minutes, Aug. 24, 1843 to Oct. 11, 1858

1824 Exhibition

216-A-2: Committee on Premiums and Exhibitions, report, Apr. 12, 1824

216-A-4: Committee on Premiums and Exhibitions, correspondence, Oct. 8-10, 1824

216-A-7: Committee on Arrangements, report, 1824

216-A-11: Accounts, Nov. 28, 1824

216-B-1 to 217-B-3: Judges' reports
[Metals, chemicals, machines, earthenware, cotton and linen goods, leather, glass, cabinet ware, straw goods, paper, classical instruments, musical instruments, fine arts, agricultural implements, colors and paints, musical instruments (correspondence), time pieces.]

217-B-6: List of articles received

217-E-8: Expenses

218-A-1: Committee on Premiums and Exhibitions general report, 1825

218-A-12: Financial report

218-B-1: Committee on Arrangements, correspondence

218-B-2: Committee on Arrangements, correspondence

218-B-4: Report

218-B-6: Minutes

218-B-9: Premiums proposed, 1826

218-C-4: Committee on Premiums and Exhibitions, membership list

219-A-2: Judges' reports

220-D-12: Delivery notices

221-C-2: Manuscript catalog with awards noted

223-D-2: Committee on Premiums and Exhibitions, final report

224-C-1: Certificates concerning exhibited items

224-D-2: List of premiums, 1826

224-E-2: Committee on Premiums and Exhibitions, minutes, Feb. 17 to May 29, 1826

225-A-1: Report

225-A-5: List of judges

226-B-1: Judges' reports

227-A-7: Correspondence

227-C-1: Manuscript catalog

228-C-2: Committee on Premiums and Exhibitions, report

1827 Exhibition

229-A-1: Premiums proposed, Dec. 13, 1826

229-A-6: Committee on Arrangements

229-A-8: Committee on Premiums and Exhibitions, minutes, Sept. 24, 1827

229-A-10: Report

229-A-12: Judges' reports

230-D-1: Exhibitors' correspondence

230-E-1: Committee on Premiums and Exhibitions, report, Feb. 7, 1828

1828 Exhibition**230-E-2:** Address**231-A-1:** Judges' reports**232-A-2:** Newspaper clippings, exhibitors' data**232-B-2:** Committee on Premiums and Exhibitions, report, [Feb. 7, 1828]**1829 Exhibition****232-D-1:** Committee on Premiums and Exhibitions, report, Jan. 1829**PRINTED RECORDS**

[Enhanced images for 233-A-2 through 233-G-14 may be found on Card 536 of the microfiche file.]

233-A-2: First annual report of the Proceedings of The Franklin Institute
Including texts of charter, constitution and by-laws with a list of the members, and officers for 1824 and 1825.

233-B-1: By-laws**233-B-4:** Officers**233-B-5:** Members, with occupations**233-C-9:** Quarterly reports of Board of Managers**233-D-9:** 1824 Committee on Premiums and Exhibitions, report**233-F-1:** 1824 judges' reports**233-G-14:** 1825 proposed list of premiums**234-B-1:** 1825 Committee on Premiums and Exhibitions, report**234-F-1:** 1826 Committee on Premiums and Exhibitions, report**234-G-1:** 1827 Committee on Premiums and Exhibitions, report**235-A-2:** 1828 address with list of premiums**235-A-5:** 1828 Committee on Premiums and Exhibitions report with abstracts of judges' reports**235-B-2:** 1830 Address**235-B-10:** 1830 Committee on Premiums and Exhibitions report**235-D-2:** 1831 Committee on Premiums and Exhibitions report**235-E-2:** 1831 Catalog**235-G-2:** 1832 Address**236-A-2:** 1833 Address**236-B-1:** 1833 Committee on Premiums and Exhibitions, report**236-C-2:** 1835 Committee on Premiums and Exhibitions, report**236-D-3:** 1838 Committee on Premiums and Exhibitions, report**236-F-2:** 1840 Committee on Premiums and Exhibitions, report**237-A-1:** 1842 Committee on Premiums and Exhibitions, report**237-C-14:** 1842 Address by Alexander Dallas Bache**237-E-4:** 1843 Address**237-E-8:** 1843 Committee on Exhibitions, report**238-A-10:** 1843 Address by Robert M. Patterson**238-B-11:** 1844 Committee on Exhibitions, report**238-E-6:** 1844 Address by Frederick Fraley**238-F-4:** 1845 Committee on Exhibitions, report**239-B-2:** 1846 Committee on Exhibitions, report**239-D-6:** 1846 Address by Solomon W. Roberts**239-F-4:** 1847 Address by Owen Evans**239-F-5:** 1847 Committee on Exhibitions report**240-A-10:** 1947 Catalog

- 240-C-10:** 1847 Address by Joseph R. Chandler
- 240-E-2:** 1848 Committee on Exhibitions report
- 240-F-14:** 1848 Catalog
- 241-A-10:** 1848 Address by Joseph R. Ingersoll
- 241-C-2:** 1849 Committee on Exhibitions, report
- 241-E-2:** 1850 Committee on Exhibitions, report
- 241-G-3:** 1850 Catalog
- 242-C-2:** 1851 Committee on Exhibitions, report
- 242-E-5:** 1852 Committee on Exhibitions, report
- 243-A-2:** 1852 Address by William D. Kelly
- 243-B-6:** 1852 Appendix
- 243-B-9:** 1852 Map of exhibit area
- 243-B-12:** 1852 Catalog
- 243-E-1:** 1853 Committee on Exhibitions, report
- 244-A-6:** 1853 Address by George Harding
- 244-B-4:** 1853 Catalog
- 244-D-4:** 1854 Catalog
- 244-F-12:** 1854 Committee on Exhibitions, report
- 245-B-12:** 1854 Address by Thomas Balch
- 245-C-6:** 1856 Catalog
- 245-E-12:** 1856 Committee on Exhibitions, report
- 246-B-8:** 1856 Address by Henry D. Gilpin
- 246-D-1:** 1858 Catalog
- 246-E-14:** 1858 Report
- 247-E-1:** 1874 Committee on Exhibitions, report with map, information, and judges

247-G-6: 1874 Catalog, with index to exhibitors

248-A-9: 1874 Reports of judges

249-G-4: 1874 Address by Coleman Sellers and closing ceremonies

250-A-2: 1874 Supplemental reports of judges of the trials of steam boilers

THE INTERNATIONAL ELECTRICAL EXHIBITION AND CONFERENCE, 1884

In 1882, Charles H. Banes, Chairman of the Committee on Exhibitions and past-president of The Franklin Institute, suggested that the Institute "take steps to hold an exhibition of electric lighting and of machinery pertaining thereto." The matter was referred to Banes' Committee on Exhibitions. On Feb. 14, 1883, the Board of Managers adopted the Committee's recommendation to organize an "International Exhibition of Electrical Subjects." (1) The Board appointed a committee to look into assembling a concurrent conference of electricians. The Committee on Exhibitions was expanded to include all of the Board of Managers and any others required by the Chairman. Petitions were sent to Washington for duty-free entrance of foreign exhibits and for the authorization to hold an international conference. Both permits were granted.

The exhibition was held on a vacant lot owned by the Pennsylvania Railroad, just west of the Schuylkill River in west Philadelphia, where the Institute built a temporary structure. Additional space was obtained to house steam boilers.

Advance publicity included a semi-monthly *Bulletin* published from June 2 to Oct. 15, the end of the exhibition. Two issues, the first and the last, were filmed; see fiche 278-A-1. Over 2,000 copies of each *Bulletin* were distributed free to colleges, libraries, and scientists throughout the United States and Canada. The *Bulletin* contained illustrated advertisements of electrical apparatus and articles relating to the progress of the exhibition which opened Sept. 2, 1884. With the help of railroad officials, lithographs of the buildings were placed in every important depot and station of the Pennsylvania and Reading Railroads.

The Electrician of the Exhibition was Edwin J. Houston, Professor at Central High School, and

his assistant was Carl Hering. Both men would later become presidents of the American Institute of Electrical Engineers (Houston in 1894, Hering in 1900). Hering had been The Franklin Institute's representative to the Vienna electrical exhibition in 1883. Houston gave a series of lectures on electricity and over 80,000 copies of his four- and eight-page *Primers of Electricity* were sold during the Philadelphia exhibition. (A spoof of Houston's *Primer* was written: "*Primer on Electricity No. 0, Copied Wrongly by Prof. How's-it-Done?*" "*How's-it Done*" is a play on Houston's pronunciation of his name: House-ton. See fiche 287-F-7). This has been filmed and copies of both "Primers" are in The Franklin Institute Archives records of the exhibition.

These lectures were part of the educational aspects of the exhibition. Visiting electricians inspected imported test apparatus. Laymen were introduced to electricity through a variety of exhibits. A water fountain was electrically illuminated. The basin was thirty feet in diameter and through a system of pumps re-used the same water. The fountain was illuminated at night with prismatic changes of color. Music was supplied by an organ operated from a keyboard located at a distance. An Edison motor furnished movement for the bellows. Elsewhere, an electric railway was in full operation on a circular 400-foot track. The Brush Company's exhibit contained a diningroom, bedroom, and living-room, each illuminated electrically. (Descriptions of exhibits are in the *Catalogue* alphabetically arranged by exhibitor. This was filmed.) The exhibit hall itself was lit by both arc and incandescent lights. Less than a decade after the introduction of electric lighting systems, prospective customers could see the new apparatus and learn just what it actually was and did.

The telephone had been first exhibited in 1876; by 1884 American Bell and Western Electric were displaying "historic telephones" next to the newest improvements. A telephone exchange system was established connecting some twenty-five exhibitors with the offices of the Exhibition and with the subscribers of the Philadelphia Exchange. This was a considerable improvement over the telephone display of 1876. At that time the demonstration had to be done on a Sunday because the exhibition was closed. Alexander E. Outerbridge, who had assisted in giving the

Emperor of Brazil and Sir William Thomson the first exhibition of the telephone, recalled that "the voice in the phone was too weak to be heard at all on week days." (2)

School children were particularly encouraged to see the exhibits. City schools granted one day to attend the exhibition. Ninety-seven schools (740 teachers and 16,657 students) received tours conducted by men expert in electricity. The Institute's special subcommittee on schools offered \$5 gold pieces and a certificate as prizes for the best essays entitled "What I saw at the Electrical Exhibition." The entries were read by a Committee of Judges which included James MacAllister, Superintendent of the Public Schools. The essay was to include an account of some electrical phenomenon, piece of machinery, apparatus or appliance on exhibit. The points considered by the judges were the discrimination exhibited by the student in selecting the object, and the clarity and accuracy of description. Eighty prizes were awarded—sixteen to high and normal school students, the remainder to grammar and unclassified school students. *Electrical World* also offered two prizes of \$10 and \$15 (3).

The Franklin Institute also assembled a Memorial Library on electrical subjects. International in scope and authorship; over 3,000 titles were collected. There were bound and unbound volumes, serials, pamphlets, manuscripts, and excerpts. A subject-matter catalog was compiled by E. Hillebrant, the Institute's Librarian and published as part of the general catalog.

The proceedings of the concurrent electrical congress were also published. The announcement of the International Electrical Exhibition had been the stimulus for a "Call" for a national electrical society. *Electrical World* published this "Call," saying that it would be a "lasting disgrace to American electricians if no American national electrical society was in existence to receive... foreign electrical savants" (4). The American Institute of Electrical Engineers was the resulting organization and the 1884 Conference was AIEE's first annual meeting (5). The Franklin Institute's Electrical Society had been active in planning the exhibition, but the Section soon declined, eclipsed by the New York-based national society. Philadelphians joined the new organization; Edwin Houston was elected one of the first managers. Part of the reason for the decline of the Electrical Section's activities was

the shift of focus by the Institute's "Electrical" members away from local meetings and toward the national ones.

The records of this exhibition-conference were extensively filmed due to the particularly significant character of the activities and personnel. This was the fourth international electrical exhibition in the world, and the first in the United States. It occurred so soon after the installation of the Pearl Street Station (1882) that the exhibits were "state of the art." The wide scope of the advertising campaign, reflected both in lists of addresses to which information or the Bulletins were sent and the newspaper coverage show considerable effort and planning. It would be interesting to know if any of the school students who received awards for their essays went on to become electricians. The exhibitors showed a high degree of sophistication in presenting their products in a "real-life" situation, bringing the new technological marvel down to the human level of a livingroom with an electrical chandelier. The symbolism and graphics of the posters are also artistically interesting. This exhibition's records show both the product and the packaging, and the product is the advanced state of the electrical industry in 1884.

- (1) "General Report of the Chairman of the Committee on Exhibitions" (Philadelphia: The Franklin Institute, 1885) p. 5. Banes' Report contains an account of the planning and preparations for the Exhibition and a description of the advertising and the committee.
- (2) Outerbridge to Trout, Jan. 31, 1926, in Silas Edgar Trout, *The Story of the Centennial* (private printing, 1929), p. 231.
- (3) Banes, *ibid.* pp. 13-14.
- (4) Call, *Electrical World*, III (Apr. 14, 1883), pp. 111-112.
- (5) See A. Michal McMahan, "Corporate Technology: The Social Origins of the American Institute of Electrical Engineers," *Proceedings of IEEE* 64:9 (Sept. 1976), pp. 1383-1389, for a discussion of founders of AIEE. This issue is the Bicentennial issue: Two Centuries in Retrospect.

251-A-1 to 296-B-1

INTERNATIONAL ELECTRICAL EXHIBITION AND CONFERENCE, 1884

- 251-A-1:** Report of Admissions Committee
- 251-B-1:** Report from the Committee on Commerce on the bill to authorize the appointment of a scientific commission which may conduct a national conference of electricians in 1884
- 251-B-3:** Request from The Franklin Institute President [copy] for unexpended funds from appropriation, 1885
- 251-B-6:** Rep. Mutchler's Bill (H.R. 2655) on scientific commission, Jan. 8, 1884
- 251-B-9:** Page from *Congressional Record* [n.d., ca. 1884] on passage of Joint Resolution (H. Res. 337) for the admission free of duty of articles for exhibition
- 251-C-1:** Paper, Nils Kolkin, "The Chemistry of Ethereal Matter," with stamp of Memorial Library, 1884
- 252-A-3:** L. C. Flagg, composition book of newspaper clippings, advertising [Index 253-C-7]
- 253-E-1:** List of names [tickets, advertising, notices]
- 253-E-3:** Forms, regulations from exhibitions: Vienna 1883, Turin 1884
- 254-A-1:** Judges' forms, stationery, invitation to ceremonies, Philadelphia, 1884
- 254-A-9:** Correspondence concerning administration, form
- 254-B-8:** Program of National Conference of Electricians
- 254-C-1:** List of libraries, reading rooms, hotels to receive *Bulletins*, information about the exhibition
- 254-E-3:** Bills for advertising
- 254-E-5:** Notices, regulations
- 255-A-5:** Correspondence with American Institute of Electrical Engineers (AIEE)
- 255-A-7:** Paper, L. F. Hickernell, Past-Pres., AIEE, "Abstract of the Institute and Philadelphia, 1884" [1954]

- 255-B-2:** Draft of petition from The Franklin Institute to U.S. Senate, House
- 255-C-1:** Correspondence concerning customs regulations and imported exhibits; customs circular
- 255-D-12:** Sample space permits
- 255-E-1:** Financial records
- 256-B-10:** Form letter announcing appointment as examiner
- 256-B-12:** Announcement, in German, on Memorial Library (Edwin J. Houston)
- 256-B-13:** Announcement, AIEE, on meeting during exhibition, 1884
- 256-C-1:** *Public Ledger* clippings [Philadelphia, Sept. 1 to Oct. 10, 1884]
- 258-A-1:** Oversized scrapbook of newspaper clippings
- 276-A-1:** Four large illustrations, 12 views of exhibition
- 277-A-1:** Posters
- 278-A-1:** *Bulletin* of Exhibition, Vol. 1 No. 5, Aug. 1, 1884
- 278-B-5:** *Bulletin* of Exhibition, Vol. I No. 10, Oct. 15, 1884
- 278-D-4:** Announcement with classes of exhibits, rules; with treasury circular
- 278-F-5:** Judges' form
- 278-F-8:** "Primer on Electricity, No. 0, Copied wrongly by Prof. How's-it Done?"
- 278-G-3:** Hector Orr, address at opening of exhibition
- 279-A-2:** Exhibitors' Data, alphabetical by exhibitor
- 284-A-1:** Catalogue [with subject catalogue of Memorial Library]
- 287-C-1:** General Report of the Committee on Exhibitions' Chairman, Charles H. Banes

Reports of Examiners

- 288-A-1:** Electric lamps
- 288-C-1:** Carbons for arc lamps
- 288-C-4:** Steam boilers
- 288-F-4:** Steam engines
- 289-B-4:** Gas engines
- 289-C-5:** Batteries
- 289-G-1:** Underground conduits
- 290-E-1:** Electric telegraphs
- 290-G-1:** Electro-dental apparatus
- 291-A-1:** Applications of electricity to warfare
- 291-C-1:** Electric signaling and register apparatus
- 292-E-5:** Supplementary report of meteorological and other registers
- 292-F-5:** Applications of electricity to artistic effects and art productions
- 293-A-1:** Electro-medical apparatus
- 293-B-6:** Educational apparatus
- 293-G-1:** Efficiency and duration of incandescent electric lamps
- 295-C-4:** Dynamo-electric machines
- 296-A-1:** Mechanical and electrical tests of conducting wires

Conference Report

- 296-B-1:** Report of the Electrical Conference at Philadelphia, in Sept. 1884
Washington: Government Printing Office, 1886

THE "NOVELTIES" EXHIBITION, 1885

This was an unsuccessful revival of the generalized "exhibitions of domestic manufactures" held by the Institute during the second quarter of the 19th century. Medals were awarded, including a grand "Medal of Honor" to the invention or discovery shown at the Exhibition, which shall be held to contribute most largely to the welfare of mankind (1).

The location was in west Philadelphia, near the site of the previous year's electrical exhibition. The 1885 catalog listed nine railroad and steamship companies which agreed to provide return freight of articles which they had carried to the exhibition.

Exhibits included refrigerators, warm air furnaces, and kitchen ranges from William Sellers & Co. and a "Ventilating Chair," a rocking chair attached to a bellows, from John Ferme. John Wanamaker had a large display which included a miniature suite of rooms, mechanical and steam toys, and a case of light gymnastic and outdoor games. Wetherill & Co. exhibited 24 colored lithographs showing different combinations of colors applied to buildings of different styles (2). The Exhibition even had a Midway or avenue of amusements.

It is ironic that Wanamaker's Department Store had a large display in the 1885 exhibition; the site of the Institute's last successful general exhibition, 1874, was the future home of the Wanamaker store. By 1885 department stores, mail-order catalogs, and other forms of advertising had replaced annual exhibitions as a way of providing Americans with information on American-made manufactures. Permanent "palaces of consumption," such as Wanamaker's, replaced exhibitions in providing the range of consumer products (3). To be successful, an exhibition needed a midway and major theme, such as the Centennial, the anniversary of Columbus' discovery of the New World, or the Louisiana Purchase. A mechanics' institute was no competitor among department stores and the *Ladies' Home Journal*.

- (1) Announcement, 1885 "Novelties" Exhibition, p. 15.
- (2) Description of exhibits is from the *Catalogue*.
- (3) This phrase is from Daniel J. Boorstin, *The Americans: The Democratic Experience* (New York: Vintage Books, 1974), p. 101.

299-A-1 to 309-B-4

"NOVELTIES" EXHIBITION, 1885

299-A-1: Catalogue

301-A-1: Abstracts of Judges' reports

301-G-1: Report of Judges on water gas

302-E-1: Bulletin of Novelties Exhibition
May 15 to Nov. 1, 1885

304-E-4: Exhibitors' literature
Alphabetical; letters and claims.

308-A-1: Announcement and program of
concerts

308-C-6: "Index, Official Bulletin"
List of subscribers, with correspondence and
announcement tipped in.

309-B-4: Correspondence by class of
exhibit, with judges [begins Class No. 3]

THE NATIONAL EXPORT EXPOSITION, 1899

This was held under the joint auspices of the Philadelphia Commercial Museum and The Franklin Institute from Sept. 14 to Nov. 30, 1899. It was "unique in the commercial history of the United States" in that it was devoted exclusively to the display of American manufactures and products suited for export. (1) Some financial backing was provided by Congress. The Exposition was located on the west bank of the Schuylkill River, accessible by electric cars from every section of the city and by a station of the Pennsylvania Railroad. The permanent buildings were to become the home of the Philadelphia Museum, just as Memorial Hall (1876) was the first home of the Philadelphia Museum of Art. A concurrent International Commercial Congress was held, attended by representatives of many foreign cities and "almost every city of the United States and Canada with a population over 10,000." The occasion also marked the seventy-fifth anniversary of The Franklin Institute. Medals were again awarded and a semi-monthly *Bulletin* was published.

- (1) "The National Export Exposition for the Advancement of American Manufactures and the Extension of the Export Trade," announcement published in *Journal of The Franklin Institute* 148:8 (August 1899), pp. 148-154, describing the plans for the Exposition.

313-A-2 to 325-C-3

NATIONAL EXPORT EXPOSITION, 1899

313-A-2: *Bulletin of National Export
Exposition*, 1:1 May 18, 1899 through 1:29
Dec. 7, 1899

- 321-F-1:** List of awards
- 322-F-4:** List of judges
- 323-A-1:** Minutes of Executive Committee on awards, May 28, 1899 to July 30, 1900
- 323-B-6:** Draft, list of awards
- 324-D-12:** Stationery, picture of medals
- 325-A-1:** Postal receipts
- 325-C-3:** Exhibitors' applications, literature

Bartol Research Foundation

In 1918 Mr. Henry W. Bartol, a leader of industry in Philadelphia and a member of The Franklin Institute, bequeathed to the Institute his residual estate for the establishment and operation of a laboratory for research in the physical sciences and for the study and solution of scientific problems. After four years of litigation and another three for the remodeling of dwellings on Franklin Institute property on North Nineteenth Street, active research began in 1925. Because these buildings were unsuited for laboratories, construction was begun on the Bartol Research Laboratories of The Franklin Institute, located on the campus of Swarthmore College. Operations began there in 1928, under the direction of Dr. William F. G. Swann. During the Second World War, scientists at Bartol worked on some of the more obstinate features of radar improvement and LORAN trainer development.

As Bartol had expressed a preference for studies to be undertaken in the fundamentals of electrical science, the Foundation devoted its peacetime energies primarily to the study of matters pertaining to atomic structure and to cosmic radiation.

For additional information on the beginnings of the Bartol Research Foundation, see Howard McClenahan, "Present and Proposed Activities of The Franklin Institute," *Journal of The Franklin Institute*, 206:6 (December 1928), pp. 735-770 (especially pp. 741-743) and the Bartol Research Foundation Anniversary Issue (October 1974).

The records filmed document the early years of the Bartol Foundation, prior to Dr. Swann's appointment, and record the apparatus used in the Laboratory's beginning years.

The Bartol Research Foundation was not the only twentieth century research effort undertaken by the Institute. A Biochemical Research Foundation was placed under the Institute's trusteeship in 1935. Its laboratories were adjacent to the campus of the University of Delaware in Newark, Delaware. The Franklin Institute Research Laboratories developed out of defense research during the Second World War; its peacetime activities have focused on applied physics, electrical engineering, materials science, and whether the Liberty Bell could withstand being moved to a new pavilion in 1976 (the answer was that it could, and it did, on a specially designed platform).

336-A-1 to 336-A-8

BARTOL RESEARCH FOUNDATION

336-A-1: Laboratory and other apparatus taken from the Institute's collections for use at Bartol Laboratory.

336-A-5: Bartol Research Foundation Committee report to managers, 1924

336-A-8: Minutes of committee, June 2, 1925

Commemorative Volumes

On the golden and diamond jubilees of The Franklin Institute, commemorative exercises were held and special volumes issued. These volumes give contemporary perspectives on The Franklin Institute both in terms of its achievements and on its future course. The addresses presented in these two volumes illuminate the historical place of The Franklin Institute in the rapidly changing technological culture of the last half of the 19th century. A centenary commemorative booklet has also been filmed.

337-A-1 to 341-A-1

FRANKLIN INSTITUTE
COMMEMORATIVE VOLUMES

337-A-1: Commemorative exercises at the fiftieth anniversary of The Franklin Institute, Feb. 6, 1874

[Fraleigh, Frederick; Rogers, Robert E.; Morton, Henry; Sellers, Coleman]

338-A-1: Commemorative exercises at the seventy-fifth anniversary of The Franklin Institute, Oct. 2 to 7, 1899

[Birkinbine, John; Richards, Joseph W.; Wiley, Harvey W.; Himes, Charles F.; Hoadley, George A.; Houston, Edwin J.; Pope, Ralph W.; Kirchhoff, Charles; Lewis, Wilfred; Sellers, Coleman; Kennelly, A. E.; Mendenhall, T. C.; Thruston, Robert H.; Melville, George W. (Rear Adm.); McCook, Henry C. (Rev.); Wilson, William P.]

341-A-1: Centenary of The Franklin Institute of Pennsylvania

[Includes numerous photographs.]

ICONOGRAPHIC MATERIALS

The Historical Collections of The Franklin Institute contain extensive visual documentation of American technological growth. The scope of the visual materials is as vast as the range of interests of the nineteenth century Institute's membership. Several of the collections have been filmed as part of this microfiche collection. The images selected complement the textual records as well as form part of the documentary evidence of the making of industrial America.

Lecture Lantern Slides

The first record series combines both textual and visual materials and overlaps several of the Institute's committees. This is a series of records of lecture lantern slides. Shortly after its founding, The Franklin Institute began to offer lectures. These were held in the evenings and ranged from subjects of practical use to the newest scientific theories. In conjunction with the Committee on Instruction, the Institute's managers planned lectures of both popular appeal and scientific interest. This practice continues today.

When the specialized Sections were organized in the last quarter of the nineteenth century, presentations of interest to the professional members of the various Sections were frequently illustrated with lantern slides and often published in the *Journal of The Franklin Institute*. The educational value of these meetings was increased through the scholarly reputation and widespread distribution of the *Journal*.

A sample of twenty lectures and one Committee on Science and the Arts report reproduced on thirteen microfiche demonstrates the wide range of interests of Institute membership between 1881 and 1921. The Committee on Science and the Arts report no. 1458 awarded the Elliot Cresson medal to Herman Hollerith for his Electric Tabulating System in 1890. Of special interest to any urban organization is the "Smoke Nuisance and Its Regulation," a series of discussions from Apr. 21 to Oct. 20, 1897. The "recent" discovery by Roentgen caused considerable discussion and slides of the pioneering x-rays are part of Houston and Kennelly's 1896 lecture. High-speed photography was of interest to many amateur and professional photographers in 1911. Gustave Dietz, of the Multispeed Shuttle Company, gave a demonstration of flashlight photography, taking and developing lantern slides as part of his presentation. These included slides of chickens tossed into the air, part of the audience (estimated to be 300), a cigar-smoking gentleman, and a group of three gentlemen and a lady.

The textual materials are double-shot; some of the images are faint.

342-A-3 to 353-E-1

FRANKLIN INSTITUTE LECTURE
LANTERN SLIDES

342-A-3: "A fourth state of matter,"
Alexander E. Outerbridge, Jr., Feb. 17, 1881
Journal of The Franklin Institute, v. 111, pp.
287-297.

342-D-2: "Percussion rock drills," Robert
Grimshaw, June 15, 1881
Journal of The Franklin Institute, v. 112, pp.
50-56.

342-F-2: "Abstract of 'influence of pulley
diameter on the driving power of flat belts,'"
Robert Grimshaw, Apr. 26, 1882
Journal of The Franklin Institute, v. 113, pp.
460-461.

343-A-3: "Screw threads," John L. Gill, Jr.,
Nov. 16, 1887
Journal of The Franklin Institute, v. 125, pp.
185-199.

343-F-2: "Weighing machines," William
Kent, Feb. 10, 1888
Journal of The Franklin Institute, v. 126, pp.
169-189.

344-B-2: "The Hollerith electric tabulating
system," CSA No. 1458, Jan. 2, 1890
Journal of The Franklin Institute, v. 130, pp.
300-306.

344-E-3: "A graphic representation of the
magnetic field," Edwin J. Houston, May 31,
1892
Journal of The Franklin Institute, v. 134, pp.
75-86.

345-A-2: "Some additional notes on the
graphic representation of magnetic fields,"
Edwin J. Houston, June 28, 1892
Journal of The Franklin Institute, v. 134, pp.
240-244.

345-C-2: "The road movement," Lewis M.
Haupt, Nov. 11, 1892
Journal of The Franklin Institute, v. 135, pp.
1-16.

345-F-2: "Artificial refrigeration through
street pipe lines from central stations,"
David Branson, Nov. 15, 1893
Journal of The Franklin Institute, v. 137, pp.
81-93.

346-B-2: "The application of electricity to
the bleaching of textile fibres," Louis J.
Matos, Nov. 30, 1894
Journal of The Franklin Institute, v. 139, pp.
177-197.

346-F-2: "High-speed photography," G.
Dietz, Oct. 5, 1911
Journal of The Franklin Institute, v. 173, p.
510.

347-A-2: "The Roentgen rays," Edwin J.
Houston and A. E. Kennelly, Feb. 19, 1896
Journal of The Franklin Institute, v. 141, pp.
241-278.

347-E-3: "Machine substitutes for the
composition of types by hand," Harold M.
Duncan, Feb. 26, 1897
Journal of The Franklin Institute, v. 144, pp.
242-281.

348-C-3: "The smoke nuisance and its
regulation, with special reference to the
condition prevailing in Philadelphia —
improved furnaces and mechanical stokers,"
series of presentations and discussions, Apr.
21-Oct. 20, 1897

Requested by Philadelphia's Board of Health.
Speakers include: A. E. Outerbridge, Jr. (citing
experience in Ohio, Boston, Russia), William
R. Roney, Thos. P. Roberts, Samuel M.
Vauclain, Arthur Kitson, Dr. William H. Ford
(pres., Philadelphia Board of Health), H. H.
Supplee, H. W. Spangler, A. Falkenau, and F.
Lynwood Garrison.

Outerbridge closing discussion (348-A-1).
Appendix includes discussion by manufactur-
ers of a variety of stokers and means of
measuring smoke.
Journal of The Franklin Institute, v. 143, pp.
393-424; v. 144, pp. 17-61, 401-442; v. 145,
pp. 1-24, 107-133.

351-A-3: "Speed government in
water-power plants," Mark A. Replogle,
Dec. 14, 1897

Journal of The Franklin Institute, v. 145, pp. 81-99.

351-D-2: "Recent improvements in x-ray tubes," H. Lyman Sayen, Apr. 20, 1898

Journal of The Franklin Institute, v. 146, pp. 441-446.

351-F-3: "Mistakes in the rating of incandescent lamps," Arthur J. Rowland, Jr., Sept. 19, 1900

Journal of The Franklin Institute, v. 150, pp. 241-272.

352-C-3: "The construction and inspection of steam boilers with especial reference to the 'City of Trenton' disaster," Oct. 16, 1901

Journal of The Franklin Institute, v. 153, pp. 321-450.

353-A-3: "On the speed of the invisible portions of the spectrum," Paul R. Heyl, June 19, 1907

Journal of The Franklin Institute, v. 164, pp. 81-112, 295.

353-E-3: "America's petroleum problems," J. O. Lewis, Jan. 27, 1921

Journal of The Franklin Institute, v. 191, pp. 357-379.

Welsbach Collection

Relatively few visual materials remain of the factories and worksites of the nineteenth century. The Franklin Institute has two collections which graphically document actual work environments—the Welsbach Gas Light Company and the Midvale Steel Company Collections.

Dr. Carl Auer von Welsbach invented a gas mantle in 1886, enabling the gas light industry to compete with the new electric lighting for another twenty years. In 1887 Dr. von Welsbach sold the patent rights to a subsidiary of the Philadelphia Gas Improvement Company. In 1890 a factory in Gloucester, New Jersey, began production of gas mantles and fixtures. The 980 lantern slides and 40 postcards, ca. 1890-1910, document the production and marketing of this gas mantle.

The mantle was made of webbed cloth dipped in a solution of rare earth elements and processed into a hardened form. When suspended over a gas flame produced by a Bunsen burner, the mantle was quickly heated to incandescence, giving off a bright white light.

The collection illustrates the various processes in manufacturing the Welsbach light, working situations at the Gloucester factory, mining techniques for monazite sand in Brazil and North Carolina (the substance from which the rare earth elements were extracted), advertising schemes showing sample rooms at home or in an office, efficiency graphs, illumination charts, gas lighting scenes, models of the Welsbach lamps and other gas lamp inventions.

Carl Auer von Welsbach received the Elliot Cresson medal (Committee on Science and the Arts report No. 2130) for the discoveries regarding the metallic oxides and for the invention of a mantle by the use of which these metallic oxides were made commercially available as a source of artificial light. The Welsbach Gas Light Company received the Longstreth Medal of Merit for the successful industrial development of these discoveries (1).

The lantern slides were organized and numbered by the Welsbach Company. Descriptions are limited to the information recorded on the original slide itself. Not all of the strictly technical graphs were reproduced because they did not photograph well and are of narrow interest.

(1) See *Journal of The Franklin Institute*, v. 150, December 1900, pp. 406-415.

355-A-1 to 362-D-11

WELSBACH COLLECTION

355-A-1: Production

355-E-4: Mantle webbing

355-F-1: Advertising

356-A-9: Historical burners

356-E-2: Founders

356-E-6: Advertising

356-E-9: Efficiency studies

356-F-2: Gas lamps

- 356-F-11: Advertising
- 357-A-1: Photometric curves
- 357-A-6: Lighting schemes
- 357-C-11: Mining techniques
- 357-F-6: Photometric curves
- 357-G-1: Gas lamps
- 357-G-5: Lighting schemes
- 357-G-8: Efficiency studies
- 358-A-9: Lighting schemes and measures
- 358-D-1: Trimming gas lamp
- 358-E-4: Lighting schemes
- 358-E-8: Gas lamps
- 358-F-9: Lighting schemes
- 359-B-3: Mantle webbing
- 359-C-1: Lighting schemes
- 359-C-7: Photometric curves
- 359-D-8: Efficiency studies
- 359-F-1: Lamp diagrams
- 359-F-5: Lighting schemes
- 359-F-9: Photometric curves
- 359-G-7: Lighting schemes
- 360-A-1: Factory buildings and grounds
- 360-C-1: Production
- 360-D-1: Efficiency studies
- 360-E-1: Gas lamps
- 360-E-8: Gas light photography
- 360-F-1: Mantle on burner
- 360-F-6: Efficiency studies
- 361-A-1: Production
- 361-B-1: Gas light photography
- 361-B-10: Gas lamp and diagrams
- 361-D-9: Efficiency studies

362-D-11: Production

Midvale Steel Company Collection

The Midvale Steel Company, located in the Nicetown section of Philadelphia, was founded in 1867 by Sheffield industrialist and steel merchant William Butcher. Anxious to capitalize upon the growing demand for steel railway wheels and rails, Butcher asked Philip S. Justice, a Philadelphian with holdings in the railway supply business, to join him in starting the William Butcher Steel Works.

At first the works used the crucible steel making technique but by 1869 Butcher had installed the first open hearth, with a capacity of three and a half tons. This method produced a better quality steel, more uniform and less liable to break in service than Bessemer steel. Innovations required capital and so Butcher was forced to exchange stock for credit. An exchange of stock for machine tools made William Sellers a part-owner. In 1872 Butcher Steel Works became Midvale Steel Works and Sellers became president in 1873.

Sellers was a leading machine tool manufacturer and had been president of The Franklin Institute from 1864 to 1867. He presented a paper outlining a uniform system of screw threads at a meeting of the Institute in April 1864. The Institute recommended his system and in 1868 Benjamin Isherwood, chief of the Navy Bureau of Steam Engineering, appointed a Board to examine the system. The Board "unhesitatingly" recommended adoption of the Sellers system (1) and it soon became the standard in the United States. Sellers created an atmosphere at Midvale which encouraged further innovative work. Among those who flourished in this environment was Charles A. Brinley, chemist and superintendent in 1874. Brinley set up a lab and analyzed steel samples, keeping methodical records. Frederick Winslow Taylor also worked at Midvale, first as machine shop laborer in 1878 and then advanced up through the ranks to chief engineer in 1884.

The successful team of Sellers, Brinley, and Taylor resulted in Midvale's ability to meet the Navy's order for all-steel guns in 1880. The

Midvale Steel Company (name changed in 1880) was a steel producer that could meet the Navy's requirements. Other important ordnance contracts followed.

Midvale also produced steel for civilian purposes, e.g., heavy machinery and steel rails. In 1920 it produced the first forged pressure cylinders for oil refining; Midvale pioneered in steel for the automobile industry too.

In 1915 the company became the Midvale Steel and Ordnance Company and began regional consolidation by acquiring other steel works. This brought it into direct competition with Bethlehem Steel Company. In 1923 Midvale sold all but its Nicetown plant to Bethlehem. Competition continued and in 1955 the principal stockholders approached R. B. Heppenstall, chairman of the Pittsburgh-based Heppenstall Steel Company, to purchase the Philadelphia company. The Midvale-Heppenstall Company began operations in 1956. By 1976, however, Midvale-Heppenstall stopped production because of high fuel costs and inefficient operations.

The Midvale Company Collection consists of black and white prints, glass and cellulose negatives and written materials from the Nicetown works from 1873. Photographs dating from 1890 through 1965 illustrate factory conditions, products, machinery, personnel, and experimental testing procedures. Most of the materials filmed are textual—Brinley's Daily Notes, the superintendent's Journal (Daily Orders), and a series of in-house pamphlets concerning alloys and Midvale products. All of the combined materials illustrate part of the history of American steel making and the early history of a key steel producer (2).

- (1) Bruce Sinclair, "At the Turn of a Screw: William Sellers, The Franklin Institute, and a Standard Screw Thread," *Technology and Culture*, 10:1 (Jan. 1969), pp. 20, 29.
- (2) Much of the information for this and the Welsbach introduction is taken from the comprehensive finding aids prepared by iconographic archivist Diana Rosenwasser. See also Rosenwasser, "History in Prints: The Midvale Steel Company and the Welsbach Gas Light Company Collection of The Franklin Institute," *Philadelphia City Archives Newsletter* (No. 36, Feb. 1979), pp. 1-2.

363-A-1 to 371-A-1

MIDVALE STEEL COMPANY COLLECTION

363-A-1: Daily notes of Charles A. Brinley, 1873-1883

Made while Chief Chemist and Superintendent of Midvale Steel Works. Introduction by William P. Barba. Given by Charles E. Brinley. March 1935.

366-A-5: General Orders, 1876-1884

367-A-2: General Orders, 1884-1888

368-A-1: General Orders, 1888-1889

368-C-1: Midvale Centennial, 1867-1967

369-A-1: Heat treatment of steel, 1914 print

369-C-2: Bit and jar steel, 1915

369-C-5: Bar steel, 1914

369-F-1: Midvale stainless, 1928

369-F-8: High Speed Tool Steel, 1930

369-G-10: Constant steel

370-A-1: Carbon tool steel, 1929

370-B-1: Duredge alloy tool steel

370-B-2: Steel number 11

370-B-3: Steel number 26

370-B-4: Midvaloy number 77

370-B-7: Diamond brand steel, 1928

370-C-6: Job analysis cards, 1931-1933

370-D-9: Midvale pensioners

371-A-1: Midvale in the 1890s (1892-1904)

Frederick Graff Collection

Philadelphia's water supply system developed almost half a century earlier than New York's or Boston's, and served as an encouragement for other cities to build similar systems. Besides

improving the public health, its democratic plan of distribution by subscription reflected brilliance in design and conception. The Water Works became an aesthetic model for industrial architecture; developed by Frederick Graff, Sr., the Works have long been a source of civic pride. The location later gave impetus to the birth of Fairmount Park, yet the Works alone attracted citizens and tourists fascinated by its energy and beautiful buildings and gardens. In its heyday, the Water Works served as inspiration for artists and artisans who created many enduring statements in various media.

The primary responsibility for the Water Works belonged to Frederick Graff, Sr. and Jr. Throughout much of the nineteenth century, the Graffs, as Chief Engineers, designed and supervised the construction and operation of the Works. During their long association with the City, they collected an extensive set of documents demonstrating the technological and aesthetic dimensions of the Works. The Graff Collection covers in great detail the changing urban water system, and includes many visual items indicating the relationship of the Water Works to Philadelphia's growth.

Frederick Graff (1774-1847) was Benjamin H. Latrobe's chief draftsman and general assistant during the construction of the Centre Square Water Works. Graff left the city to design and build a bank in Norfolk, Virginia, and to work on the Santes canal in South Carolina. He returned in 1805 and was elected superintendent of the Water Works. In 1811 the Select and Common Councils of Philadelphia asked Graff and John Davis to submit proposals for a water system to replace the inadequate Centre Square Works. Graff's design for a steam-powered system at Fairmount was accepted and built from 1813 to 1815. In 1819 the Watering Committee of the Councils asked Graff for a plan to expand the Works to meet future supply needs. Graff responded with plans to convert the Fairmount Water Works into a self-contained water-powered system. This operated from 1822 to 1911.

Frederick Graff, Jr. (1817-1890) became assistant engineer of the water department in 1842 and chief engineer after his father's death in 1847. He remained in that post until 1872 when he declined re-election. During his last six years there he was also a Commissioner of Fairmount Park. The younger Graff's most notable achieve-

ment was the introduction of the Jonval turbine in 1851; turbines entirely supplanted the breast water wheels at the Works. Graff also built reservoirs and dams and enlarged the pump houses for turbine installation.

The Graffs maintained a close association with The Franklin Institute because of the Institute's role as technological advisor to the city; thus when Frederick Graff, Jr. died, the family donated their Water Works Collection to The Franklin Institute.

The Graff Collection consists of approximately 170 architectural and engineering drawings, maps, lithographs, and photographs including one six-panel daguerreotype taken around 1844, focusing primarily on the Fairmount Water Works during the two Graffs' combined tenure as chief engineers. The drawings include proposed mills and houses, not just structures actually built. Construction cost notations appear on many drawings. A volume of pen and ink drawings identifies many portions of the Works (1). Some of the beautifully hand-colored drawings do not reproduce well as negative black and white images; some of the fine contrasts are lost although the content is basically represented.

The Collection has been conserved, matting or encapsulating the drawings and photographing them. The conservation project was jointly sponsored by The Franklin Institute and the Water Department of the City of Philadelphia, Mr. Carmen Quarino, Commissioner. A detailed finding aid is available at The Franklin Institute.

(1) *Plans, Sections and Elevations of Fair Mount Water Works, Philadelphia*. Designed and Executed by Frederick Graff. Drawn by F. Graff, Jr., 1840. Graff Collection, The Franklin Institute.

372-A-1 to 372-A-2

PORTRAITS of F. Graff, Sr., and F. Graff, Jr.

By Gutekunst, Philadelphia.

372-A-3 to 372-A-11

PHILADELPHIA CITY MAPS

372-A-3: "A portraiture of the City of Philadelphia; by Thomas Holmes, Surveyor General. Sold by Andrew Slow in Sorditch, 1683"

372-A-4: "To the citizens of Philadelphia: The plan of the City and its Environs... Philadelphia in 1796. Published by Bradley and Company, Philadelphia"

372-A-5: "Plan of the City of Philadelphia and its Environs. Published by John Hills, Surveyor and Draughtsman, 1797. Engraved by John Cooke of Hendon, Middlesex, near London"

372-A-6: "Plan of the City and its Environs. Drawn under the direction of J. A. Paxton by Wm. Strickland. Jan. 1, 1811." Hand colored boundaries

372-A-7: Grades of East-West Streets of the Old City [n.d.]

372-A-8: Chart of the River Schuylkill, David McClure, 1828

372-A-9: "Map of the City of Philadelphia. Drawn by J. Simons, Phila. as it is in 1831. Published by C. P. Fessenden." [lines drawn in ink]

372-A-10: "Map of the survey of the Wissahickon Creek showing boundaries of land. Jno. C. Cresson, Chief Engineer, 1868." [With red and black notations]

372-A-11: "Map of farms and lots embraced within the limits of Fairmount Park, 1868." Three inserts: "Lansdowne Land Company Lots in 24th Ward 1868;" "Lots of the Mifflin Land Association 20th Ward;" "Plan of Ground appropriated for the preservation of the purity of water and an addition of Fairmount Park approved 1864"

372-B-1 to 372-B-8**PHILADELPHIA CENTRE SQUARE WATER WORKS**

372-B-1: Ground Plan of Engine House, 1799

372-B-2: Section through Engine House (photozincograph)

372-B-3: Sections of Engine House: Sept. 9, 1948

372-B-4: Plans and sections of wooden steam boilers, 1801-1815 (photozincograph), with plan of cast iron boiler 1804; cast iron boiler in use at the Schuylkill Engine House 1803-1815

372-B-5: Wooden boiler used for supplying the Steam Engine 1801-1815

Exterior Renderings

372-B-6: The Water Works, in Centre Square. Taken down in 1827. Drawn, engraved and published by W. Birch

372-B-7: View of the Water Works. Published by W. Quig

372-B-8: The Water Works [n.d.]

372-C-1 to 372-E-10**FAIRMOUNT STEAM WORKS**

372-C-1: Designs for the Fair Mount Water Works, 1813. [Pencil and ink on brown paper]

372-C-2: Details of Gudgeon and Steam Cylinder. [Notation: Presented for the consideration of the Schuylkill Navigation Company for the canal at Fair Mount, June 30, 1819]

372-C-3: Site plan

372-C-5: Plan of Engine Buildings

372-C-8: Detail of window and door frame

Elevation

372-D-1: Design of Engine Buildings, 1813

372-D-2: Reverse of preceding drawing (D1)

372-D-3: South flank

372-D-4: West front of engine building

372-D-5: Section of engine house (exterior)

372-D-6: Section through bays, showing water levels

372-D-7: Section of engine house

372-D-10: Section through steam engine

Details

- 372-E-3:** Detail, main pump and supply pipes
- 372-E-4:** Detail, crankshaft sections
- 372-E-5:** Reverse of preceding (E4)-Gouge
- 372-E-6:** Detail of steam cylinder
- 372-E-7:** Detail of Sluice Gateway with notes on construction, 1814-1815
- 372-E-8:** Detail of cornice pattern for engine house (reverse of preceding-E7)
- 372-E-9:** Detail of Reservoir, Morris and Pearl Streets
- 372-E-10:** Detail of reservoir showing depth

372-E-11 to 373-E-12**FAIRMOUNT WATER WORKS****Bound Volumes
(Ink Drawings)**

- 372-E-11:** Front view
- 372-F-1:** Plan of the City property at Fair Mount
- 372-F-2:** Plan
- 372-F-3:** West front
- 372-F-4:** East front
- 372-F-5:** Section of water wheel and Fore Bay, of pump chamber
- 372-F-6:** Elevation of south wing, of head arches
- 372-F-7:** Section and elevations of Fair Mount Dam
- 372-F-8:** Canal and lock on west side of the River
- 372-F-9:** Heights of freshets at different periods
- 372-F-10:** Plan and section of the pump, stop cock and iron pipes
- 372-F-11:** Plan of the Schuylkill at the falls previous to the section of the dam

Site Plan

- 372-F-12:** Corporation ground, 1822
- 372-F-13:** Reverse of the preceding (F12) showing levels
- 372-G-1:** Site Plan, T. Birch, dch.; R. Tiller, Sv.
- 372-G-2:** Plan for mills to be placed on the grounds, 1826
- 372-G-3:** Plan of the Works' Reservoirs
- 372-G-4:** Dam landings and spring garden district layout with seal, 1829
- 372-G-5:** Letter to Philip M. Price concerning measurement of height of land, with drawing, "Measures taken by F. Graff, Dec. 4, 1829"
- 372-G-6:** Reverse of preceding (G5)-Plan of embankment for Reservoir No. 4, wall on Fair Mount Street
- 372-G-7:** Map of the Eastern termination of the Philadelphia and Columbia Rail Road, 1832
- 372-G-8:** Layout of Water Works Reservoir System and River and adjoining properties with calculations by Graff, 1823-1836
- 372-G-9:** Reverse of preceding (G8)-1830 plan concerning purchases of properties by the City with later notes concerning surveying by price and cost to city legislature, 1830-1841
- 372-G-10:** Reservoirs Nos. 1, 2, 3
- 372-G-11:** Reverse of preceding (G10)-Base Line of Reservoir
- 372-G-12:** Plan of Fair Mount Docks (1838-1840)
- 372-G-13:** Map of the Fair Mount Water Works and the Eastern Termination of the Philadelphia and Columbia Railroad, 1839
- 372-G-14:** Map of Fair Mount Water Works and the Eastern Termination..., 1838, with 1840 notations
- 373-A-1:** Map of Fair Mount Water Works and the Eastern Termination, n.d. [same map as the preceding two but with less

coloring, no notations]

373-A-2: Map...Railroad, with plan for supplying Girard College with water, 1839

373-A-3: Map...Railroad, n.d., with two small portions of roads near reservoirs colored

373-A-4: Plan of city property north of the reservoirs, 1839

373-A-5: Map of Fair Mount and section of the dam, plan of one-half the Mill House

373-A-6: Reservoirs, drawn by F. Graff, 1846

373-A-7: Plan of Fair Mount property, with 1846 notations

373-A-8: Plan of Fair Mount property designed and arranged by F. Graff, with construction notations, 1812-1837

373-A-9: Plan of Lemon Hill and Sedgley Park, 1851

373-A-10: Plan of the buildings at Fair Mount, designed by F. Graff in 1819-Mill Buildings

Elevation

373-B-1: Plan of Mill Houses, 1820

373-B-2: Plan of the wings above the wheels

373-B-3: Plan showing 3 mills that could be built on grounds (never built), 1825

373-B-4: East and west fronts

373-B-5: East front

373-B-6: Elevation

373-B-7: Whole front of the building, 1819

373-B-8: Mound Dam (1822)

373-B-9: Elevation of head arches and south wing

373-B-10: Doorway to the Mill House

373-B-11: Design for the Saloon Building, 1835

373-B-12: Reverse of the preceding (B11)-Facia

373-C-1: Pavilion for the pier of the Mound Dam, 1835

Section

373-C-2: Section of North and South wings of Mill Wheel House

373-C-3: Section of Water Wheel and Fore Bay, and of pump chamber

Detail

373-C-4: Water wheels

373-C-5: Reverse of the preceding (C4)-wheel with notations

373-C-6: Design for Water Wheel No. 5, 1831

373-C-7: Design for cast iron wheel for pump No. 6, 1822

373-C-8: Plan of water wheel and pump, with results of trials of 3 wheels, Jan. 5, 1831

373-C-9: Reverse of the preceding (C8)-Cost of work and materials for wheels

373-C-10: Design of cast iron water wheel, F. Graff, 1839

373-C-11: Details of wheel drawn by F. Graff, 1841

373-C-12: Pipes and pump wheel, 1843

373-D-1: Wheel (x-s), with bill containing specifications, 1843-delivered to Merrick and Towne

373-D-2: Reverse of the preceding (D1)-Section of wheel and dimensions of shaft

373-D-3: Wheel (x-s), copy of drawing delivered to I. P. Morris and Co., 1846, with bill for wheel, starts

373-D-4: Reverse of the preceding (D3)-dimensions of arm of wheel, bucket

373-D-5: Drawing of wheel, arm delivered to I. P. Morris and Company, 1846

- 373-D-6:** Original draft of pumps, 1819
- 373-D-7:** Pipes, 1843
- 373-D-8:** Arch
- 373-D-9:** Framing and gates of the Head Arches, 1820
- 373-D-10:** Plan of Fore Bay Gates, 1842
- 373-D-11:** Sections of Fair Mount Dam, 1822
- 373-D-12:** Proposed plan of building a new dam, 1841
- 373-D-13:** Proposed plan of altering and raising dam, 1841
- 373-D-14:** Water levels at Peter Robinson's Mills above falls, 1829, and effect of raising dam on his mills, calculations 1819-1822
- 373-E-1:** Detail, fence and wall

Exterior Rendering

- 373-E-2:** Isometrical view of Fair Mount, 1843
- 373-E-3:** View of the dam and water works, 1824. Drawn by T. Birch
- 373-E-4:** View (very faint) engraved C. G. Childs, painted by Thos. Doughty
- 373-E-5:** Fair Mount water works "Dedicated to the Select and Common Councils of the City of Philadelphia"
- 373-E-6:** Bridge, "From Nature and on Stone by Geo. Lehman"
- 373-E-7:** Daguerreotype by T. P. and D. C. Collins [6 views]
- 373-E-8:** The Race Bridge, engraved at J. Andrews. From Vol. II, p. 407.
- 373-E-9:** Fairmount, 1867, J. Kiehne
- 373-E-10:** Fairmount, from Art Supplement to Appletons' Journal, 1869
- 373-E-11:** Schuylkill Water Works, J. C. Armtage
- 373-E-12:** Group of 28 photographs, 1812-1870, of water works with prints, 1799-1815

373-F-1 to 373-F-7

FAIRMOUNT TURBINE SYSTEM

Plan and Section

- 373-F-1:** Design for the alteration of the old mill building at Fairmount and substitution of turbine wheels for breast wheels, 1867
- 373-F-2:** General arrangement of new turbine and pumps
- 373-F-3:** Plan and section of new dam built, 1872
- 373-F-4:** Plan and section of new dam built, 1872

Detail

- 373-F-5:** New pumps for old Mill House
- 373-F-6:** "Pumps No. 2 and 3—Old Mill House" [faint]
- 373-F-7:** Wire Bridge and Fairmount water works [faint]

373-G-1 to 374-A-6

MAIN PIPES AND HYDRANTS

Site plan

- 373-G-1:** City plan, with estimates
- 373-G-2:** City Plan: Delaware River to West Seventh
- 373-G-3:** Plan of iron pipes and hydrants-East section
- 373-G-4:** Plan of iron pipes—mid section
- 373-G-5:** Plan of iron pipes—west section
- 373-G-6:** Plan of iron pipes: Vine to Cedar, East of Broad
- 373-G-7:** Plan of iron pipes: Vine to Cedar, West of Broad
- 373-G-8:** Plan of western section, Wood to Brown Streets, notations through 1852
- 373-G-9:** Map of water pipes, 1853 [litho]

Section and Detail

- 374-A-1:** Fire plug, 1817
- 374-A-2:** Plan of fire plug
- 374-A-3:** Fire plugs and hydrants, 1803-1844 [photozincograph by F. A. Wenderoth and Co.]
- 374-A-4:** Details of pump cock, iron and wood fire plug cases, English fire plug, 1847
- 374-A-5:** Section of fire plug, 1854 [litho]
- 374-A-6:** Design for a 16-inch stop cock, 1851

374-A-7 to 374-C-5

OTHER GRAFF PROJECTS

- 374-A-7:** Plan for a Canal around High St. Bridge [litho]
- 374-A-8:** Canal and locks at Fairmount, 1845 [faint]
- 374-A-9:** Chart of the River Schuylkill from Fair Mount to its mouth. Drawn by David McClure [with notations]
- 374-A-10:** Plan of Schuylkill River Bridge located at the Falls, 1823, for the purpose of evidence in suit pending between the City and the Bridge Company, with notations to 1839
- 374-B-1:** The Schuylkill measured by F. Erdman, Jan. 23, 1830, with water levels, 1816-1839
- 374-B-2:** "Design should it be deemed appropriate to open the streets through Penn Square," presented to Town Council, 1827
- 374-B-3:** Plan of Penn Square, 1827
- 374-B-4:** "Plan No. 2"—cross canal between basins off Schuylkill River
- 374-B-5:** Plan No. 2: "Design for improvement of City Ground at Schuylkill"
- 374-B-6:** Reverse of preceding (B5)-City property
- 374-B-7:** Comparative Reservoir Depths, water levels on Delaware River and standpipe measurements

374-B-8: Centennial Fountain Plan

374-B-9: Reverse of preceding (B8)-Diagram of Main; Perspective of fountain and building

374-B-10: Centennial W. W. Delivery Pipe, 1875

374-B-11: Centennial distribution system details

374-B-12: Elevation and section of Chimney at College Point, with stamp of H. R. Worthington Hydraulic Works, Brooklyn

374-C-1: Plan of a basin and location of a rail road by E. Lewis, done by G. Strickland (hand-colored litho)

374-C-2: "City Water Works arranged by G. Evans" x-s of pump with notations by Graff, ca. 1828

374-C-3: The Upper Ferry Bridge, Robert Mills, architect. Thos. Birch, pinx. Lewis Wernag, Inventor

374-C-4: Lancaster-Schuylkill Bridge, Invented by Lewis Wernag, executed by him and Joseph Johnson. General finish by R. Mills. Drawn and aquatinted by W. Strickland

374-C-5: Topographical map of West Point, presented by Cadet P. H. Colquitt, Aug. 10, 1852

Naval Architecture

THE JOHN LENTHALL AND WILLIAM CRAMP SHIP YARD COLLECTIONS

The John Lenthall Collection documents part of the history of America's sailing navy and the beginnings of the steam and iron navy. Some of the vessels were designed by Samuel Humphreys, chief constructor of the Philadelphia Navy Yard. John Lenthall (1807-1882) was apprenticed to Humphreys and was an assistant naval constructor from 1828 to 1838 when Lenthall became a constructor. As Humphreys'

assistant he prepared plans and specifications and may have helped supervise the work of construction (1).

Some of the Humphreys designs filmed as part of this Collection are the frigate *Congress* (rebuilt in 1837), the last sailing frigate designed for the United State Navy, and the *John Adams* (rebuilt and launched from Norfolk Yard in 1830). Lenthall designed the sloop of war *Germantown*, built at the Philadelphia Yard from 1843 to 1846. The plans for this sloop are in far greater detail than most of her class and are of value in showing the deck fittings of corvettes of her date. Lenthall's *Dale* was one of five built from his designs of a new class of ship, a 16-gun sloop, "3rd Class." All five were launched in 1839; the *Dale* lasted until 1906, spending several years as a school ship (2).

Lenthall also designed packet ships including one or two for the Cope Line. Lenthall was one of the many naval architects who spanned the transition from sail to steam. See, for example, the drawings of the side-wheel steamer *Susquehannah* and the light draught monitor *Shiloh*. William Cramp and Sons' Ship and Engine Building Company also spanned this transition. Hull no. 235, the *Philadelphia*, had sails and an engine (as many early steamers did).

William Cramp founded Cramp's Ship Yard in 1830, and in 1872 the Yard was incorporated as The William Cramp & Sons' Ship and Engine Building Company. By 1899 the Company had acquired the I. P. Morris Company's Port Richmond Iron Works. During the Civil War the Cramp Yard built several ships for the United States Navy, including the ironclad *New Ironsides* (completed in 1862) and the double-ended gunboat *Wyalusing* (completed in 1863); after the war the yard built the monitor *Terror* (1888). The yard built the first steam tug, the first compound and the first triple expansion and the largest quadruple expansion sea-going engine in the United States; an advertisement shows a picture of the USS *Maine*, described as "Now Building" (3). Cramp also built ships for Japan (*Kasagi*), for Russia (*Verlag*), for the New York and Cuba Mail Steamship Company, and sea tugs for the Philadelphia and Reading Transportation Line.

John Lenthall became a member of The Franklin Institute in 1836 and a Life Member in 1850. In 1874 he deposited in the Institute's Library his books, drawings of naval vessels,

memoranda, and other papers. With few exceptions, the naval architectural drawings were made (and signed and dated) by Lenthall, and represent vessels for the design and construction of which he was responsible. Not all of the Collection has been filmed; selections were made to represent the beauty and diversity of this naval architect's work.

William Cramp (1807-1879) was president of the Cramp Shipbuilding Company from 1830 to 1879; he was one of the first shipbuilders to make the change from wood to iron and steel. In 1904 the Company wrote to The Franklin Institute regarding the attendance and averages of students of the School of Naval Architecture employed by them (4). The Collections of hull and engine contracts, ledgers, books of lines, photographs of christenings, pictures and glass negatives of Cramp-built ships and the shipyard, and the record book of apprentices was a gift of the Company in 1946. The selections in the microfiche collection show the diversity of the shipyard's work. Finding aids to both collections are available at The Franklin Institute.

- (1) Howard I. Chapelle, *The History of the American Sailing Navy: The Ships and Their Development* (New York: Bonanza Books, 1949), p. 354.
- (2) Chapelle, pp. 359, 402, 404. He also reproduces several Lenthall drawings.
- (3) Cramp Advertisement, National Export Exposition *Bulletin* 1:29 (Dec. 7, 1899), n.d. See fiche 319 D7-8.
- (4) Letters from The William Cramp & Sons' Ship & Engine Building Co. to H. L. Hyle, Apr. 16 and Sept. 21, 1904. Committee on Instructions, General Correspondence, 1904-1907.

375-A-1 to 447-A-1

CRAMP SHIPBUILDING COMPANY

375-A-1: Hull Nos. 186-191 Colliers, curve of form

375-A-2: Hull No. 194 Tugboat *Stephens*, curve of form

375-A-3: Hull No. 195 Monitor *Terror*, curve of form

375-B-1: Hull No. 200 Corvette *Europe*, curve of form

Bibliography of Documents

388-B-1

- 375-B-2:** Hull No. 203 Cruiser *Zabiaka*, curve of form
- 375-B-3:** Hull No. 204 Steamship *Asia*, curve of form
- 376-A-1:** Hull No. 207 Steamship *Chalmette*, curve of form
- 376-A-2:** Hull No. 208 River Steamer *Gratitude*, curve of form
- 376-A-3:** Hull No. 210 Schooner *Josephine*, curve of form
- 376-B-1:** Hull Nos. 213-214 Steamers for Quintards, curve of form
- 376-B-2:** Hull No. 216 River Steamer *Wilmington*, curve of form
- 376-B-3:** Hull Nos. 220-221 Side Wheel Steamboats, curves of form
- 377-A-1:** Hull No. 232 Tugboat *Geo. W. Pride, Jr.*, curve of form
- 377-A-2:** Hull Nos. 233-234 Steamships *Mariposa* and *Alameda*, curves of forms
- 377-B-1:** Hull Nos. 237-238 Tugboats *Ivanhoe* and *Hinton*, curves of forms
- 377-B-2:** Hull No. 246 Steam Yacht *Peerless*, curve of form
- 377-B-3:** Hull No. 248 Ferry *John King*, curve of form
- 378-A-1:** Hull No. 253 Steamship *Olivette*, curve of form
- 379-A-1:** *Colombia* and *Venezuela*, stability curve
- 379-A-2:** Hull No. 263 *Venezuela*, dimensions of hull
- 379-A-3:** USS *Indiana* and *Massachusetts*, general arrangement of armor
- 380-A-1:** Hull No. 197 *St. Paul*, launching particulars
- 380-B-1:** Hull No. 197 *St. Paul*, sheer, half-breadth, body plan and curve of form
- 381-A-1:** Hull No. 197 *St. Paul*, inboard profile
- 381-A-2:** Hull No. 277 *St. Louis*, launching particulars
- 382-A-1:** Hull No. 197 *St. Paul*, launching diagrams
- 383-A-1:** Cruiser *Yoshino*, equivalent girder
- 383-A-2:** Cruiser *Yoshino*, launching diagrams, Jan. 20, 1898
- 383-B-1:** Hull No. 301 Cruiser *Variaq*, sheer, half-breadth body plans
- 384-A-1:** Hull No. 301 Cruiser *Variaq*, launching particulars
- 384-A-3:** Hull No. 313 and No. 314 steamers *Apache* and *Arapahoe*, curves of forms
- 384-B-2:** Hull Nos. 313 and 314 Steamers *Apache* and *Arapahoe*, sheer, half-breadth body plan
- 385-A-1:** Floating derrick, curves of shearing stresses and bending moments
- 385-A-2:** Hull No. 307 pontoon crane for U.S. Navy Yard, Brooklyn equivalent girder
- 385-B-1:** Hull No. 315 prot. cruiser for the Turkish Government: *Medjidia*, sheer, half-breadth body plan
- 386-A-1:** Hull No. 315 *Medjidia*, electrical installation in dynamo room
- 386-A-2:** Hull No. 333 Ice Breaker *John Weaver*, for Philadelphia, sheer, half-breadth body plan
- 386-B-1:** Hull No. 333 *John Weaver*, launching diagram
- 386-B-3:** Hull No. 333 *John Weaver*, sketch appended to launching diagram
- 387-A-1:** Hull No. 338-339 *Momus* and *Antilles*, sheer, half-breadth body plan
- 387-B-1:** Hull No. 338 steamer *Momus*, launching diagram
- 388-A-1:** Hull No. 339 *Antilles*, launching diagram and data
- 388-B-1:** Hull No. 348 sidewheel passenger and freight steamer *Commonwealth*, sheer, half-breadth body plans

- 389-A-1:** Hull No. 348 sidewheeler for the New England Nav. Co. wave lines
- 389-B-1:** Hull No. 349 steamer *Mohawk*, sheer, half-breadth body plan
- 390-A-1:** Hull No. 300 battleship *Retvizan*, launching diagram
- 390-B-1:** Steel caisson for Boston Navy Yard Dry Dock, launching diagram
- 391-A-1:** Hull No. 311, twin screw steamer *Kroonland*, launching diagram
- 391-B-1:** Hull No. 332 twin-screw steamer *Merida*, launching diagram
- 392-A-1:** Hull No. 335 steamship *Mexico*, launching diagram
- 392-A-3:** Hull No. 335 *Mexico*, sketch appended to launching diagram
- 393-A-1:** Hull No. 340 steamer *Havana*, launching diagram
- 393-A-3:** Hull No. 341 steamer *Saratoga*, launching diagram
- 393-B-1:** Hull No. 343 steamer *Bunker Hill*, launching diagram
- 394-A-1:** Hull No. 342-343-344 steamer *Massachusetts*, *Commonwealth*, and *Old Colony*, sheer, half-breadth body plan
- 394-B-1:** Hull No. 342 twin-screw steamer *Massachusetts*, launching diagram
- 394-B-3:** Proposal no. 746: flooding curves
- 395-A-1:** *Grafton*, equivalent girder
- 395-A-2:** US Cruiser *Olympia*, equivalent girder
- 395-B-1:** Battleship, unknown, deck plan
- SS *Allianca***
- 396-A-1:** Outboard profile and top views
- 396-B-1:** Hold arrangement
- 397-A-1:** Arrangement of main, hurricane and boat decks
- 397-B-1:** Steering and capstan engine foundations
- 398-A-1:** Orlop, lower and main deck plating
- 398-B-1:** Cargo hatches on main, lower and orlop decks
- 399-A-1:** Stern post and rudder, details
- 399-A-3:** Stern post forging plan
- 399-B-1:** General arrangement of scuppers, soil pipes, sluice valves, ventilation
- 400-A-1:** Details of scuppers, soil pipes and sluice valves
- 400-B-1:** Boiler and engine casing, donkey boiler foundation and fireroom vent.
- 401-A-1:** Shell plating
- 401-B-1:** Bulkhead arrangement
- 401-B-2:** Transv. W.T. and N.W.T. bulkheads
- 401-B-3:** Arrangement of Hawse pipe, windlass foundation, chain locker and pipes, bow chock
- 402-A-1:** Brine tank insulation and ice machines foundation
- 402-A-2:** Keel, keelsons, bilgekeel, inner bottom, engine and boiler foundations, details of reviting
- 402-B-1:** Cross hatch and cargo port
- 402-B-3:** Cross section and web frames
- 403-A-1:** W.T. and N.W.T. Doors
- 403-B-1:** Cargo hatch cranes
- 403-B-3:** Cutting plan of shell and deck plating
- 404-A-1:** Mast and derrick fittings, and foundation for 30 ton derrick
- 404-B-1:** Proposed rearrangement of cold storage rooms etc. "Not Approved"
- 404-B-2:** General arrangement of rigging
- 405-A-1:** Shipping of main boilers
- 405-A-2:** Refrigerating and disinfecting machinery room

- 405-B-1: Hatches and cargo ports
 405-B-3: Frame and beam list
 406-A-1: Arrangement and details of beam stanchions and girders
 406-B-1: Rail and awning stanchions and stanchions at hatches

Class C Barge

- 407-A-1: Sheer, half-breadth profile
 407-A-2: *Tulpenhocken*, deck plan
 407-B-1: Cross section, profile, deck plan

Steamship *Columbian*

- 408-A-1: Hull No. 267, deck plans
 408-B-1: Hull No. 267, inboard profile

Hull No. 245, Ship *Philadelphia*

- 409-A-1: Sail plan
 409-A-3: Deck plan
 409-B-1: Inboard profile
 409-B-2: Joiner plan
 409-B-3: Midship section
 410-A-1: Stern post
 410-B-1: Rudder
 410-B-2: Keel
 410-B-3: Stern hull
 411-A-1: Forecastle
 411-A-2: Boiler saddles
 411-A-3: Fireroom cover
 411-B-1: Plate plan
 411-B-2: Cross section
 411-B-3: Deck plan
 412-A-1: Sheer, half-breadth body plan
 412-B-1: Deck plan
 412-B-3: Midship section

413-A-1: Proposed alteration in joiner work on upper deck

413-A-2: Bulkhead

413-A-3: B. hatch

413-B-1: Proposed alteration in joiner work, interior plan

414-A-1: Fresh-water tank

414-B-1: Extension of engine hatch to top of deck house

414-B-2: Proposed alterations "Not adopted"

414-B-3: Coal bunkers "Not adopted"

415-A-1: Water ballast tank

415-A-2: Arrangement of keel and plate butts

Hull 289, Ferry *Pittsburgh*

- 416-A-1: Frames, forging plan
 416-A-2: Midship section
 416-B-1: Keel and center keelson
 416-B-3: Stern post
 417-A-1: Rudder-frames forging plan
 417-A-2: Frame list
 417-B-1: Longitudinal truss and bulkheads
 418-A-1: General arrangement and casings
 418-B-1: Hull connections for stern tube, details of castings
 418-B-3: Shaft struts
 419-A-1: Engine foundation
 419-A-2: Shell expansion
 419-B-1: Dimension for wagon way
 419-B-3: Stockless anchor
 420-A-1: Rudder and details
 420-A-3: Quadrant
 420-B-1: Shaft bearers

- 420-B-3: Type of rail stanchion
- 421-A-1: Guard braces
- 421-A-2: Pilot house lamp
- 421-A-3: Standard seat for Pennsylvania R.R. Co.'s ferry boats
- 421-B-1: Scuppers
- 421-B-2: Iron brackets
- 421-B-3: Stanchion between shade and upper deck
- 422-A-1: Boat davits and details
- 422-A-2: Heating and ventilating system
- 422-B-1: Shaft-struts
- 422-B-2: Boiler saddles
- 423-A-1: Steering gear
- 423-A-3: Section of engine room skylight
- 423-B-1: Foundations for electric engines
- 423-B-2: Details of steering gear
- 424-A-1: Upper deck gates
- 424-A-2: Main deck gates
- 424-A-3: Details of steering gear
- 424-B-1: Side lights and boxes
- 424-B-2: Disconnecting gear and indicator for steering engine
- 424-B-3: Ladder arrangement
- 425-A-1: Location of steering gear stands in pilot house
- 425-A-2: Types of letters of ferry boat
- 425-A-3: Hose reel
- 425-B-1: Flags
- 425-B-2: [2 images too faint to discern]
- 426-A-1: Heaters

Ship Princess Anne

- 427-A-1: Outboard profile

- 427-B-1: Deck plans
- 427-B-3: Section and elevation of ice house
- 428-A-1: General arrangement of galley and pantry
- 428-A-3: Cargo gear at No. 2 hatch
- 428-B-1: Arrangement and details of beam stanchions and girders
- 428-B-2: Dynamo room
- 429-A-1: Arrangements and details of soil pipes and scuppers
- 429-B-1: Air port
- 429-B-2: Rail, awning stanchions and bulwark brace detail
- 430-A-1: Porter shop and paint locker
- 430-A-2: Hatches on main and lower deck
- 430-A-3: Recess and foundation for hoisting engine
- 430-B-1: Cargo handling gear
- 431-A-1: Details for cargo hoisting gear

Steel Motor Tug

- 432-A-1: Outboard profile
- 432-A-2: Inboard profile and hold plan
- 432-A-3: Deck plans
- 432-B-1: Cross-sections
- 433-A-1: Waterlines
- 433-A-3: Shafting
- 433-B-1: Rudder-quadrant bearing

Sea Tug for Philadelphia and Reading Transportation Line

- 434-A-1: Deck house
- 434-A-2: Cross section
- 434-B-1: Outboard profile
- 435-A-1: Joiner plans
- 435-B-1: General arrangement

Bibliography of Documents

448-B-1

436-A-1: Pipes arrangement

Hull No. 256, Ship *Vesuvius*, Pneumatic Dynamite Gun Cruiser

437-A-1: Inboard profile

437-A-3: Deck plans

438-A-1: Foundations

438-A-2: Engine foundation and hull

438-A-3: Arrangement of compressing
engine

438-B-1: Deck plans for gun room,
magazine

438-B-3: Cast steel struts

439-A-1: Coal bunker and passageway

439-A-2: Quadrant and tiller

439-A-3: Rudder

439-B-1: Steer gear connections

439-B-2: Spare tiller

439-B-3: Rudder bearing

440-A-1: Steering gear connections

440-A-2: Cast steel quadrant

440-A-3: Wrought iron tiller and quadrant
frame

440-B-1: Brass steering wheel hub

440-B-2: Sighting instruments stand

440-B-3: Davit keepers

441-A-1: Fire room lockers

441-A-2: Steering gear shafting

441-A-3: Gun support

441-B-1: Proposed boom for raising
projectiles

441-B-2: Lines

442-A-1: Waterlines

442-B-1: *Curves of form*

442-B-2: Inboard profile

443-A-1: Upper and forecastle deck plans

443-B-1: Outboard profile

443-B-3: Cross section in windlass space

444-A-1: Cross sections of hull

444-A-2: Plate plan

444-A-3: Cross sections of hull

444-B-1: Hull detail

444-B-2: Bulkheads

444-B-3: Steering gear purchase blocks

445-A-1: Companion way

445-A-2: Dynamite gun cover

445-A-3: Coal scupper

445-B-1: Vents

445-B-2: Boat davits and stuffing boxes

445-B-3: Anchor davits

446-A-1: Stern post and rudder

446-A-2: Conning tower

446-A-3: Stern pipe, cast steel

446-B-1: Companion ways and engine room
skylights

446-B-2: Stuffing boxes in forecastle for
dynamite gun

447-A-1: Windlass, chain stoppers, and
hawse pipes

448-A-1 to 512-B-2

LENTHALL COLLECTION

Frigate Congress, 1837

448-A-1: Sail plan

448-A-2: Fore body plan

448-A-3: After body plan

City Ice Boat

448-B-1: *Body*

448-B-2: Sheer, half-breadth

448-C-1: Tonnage scale

U.S.S. *Constellation*, 1853

449-A-1: Outboard profile and sail plan

449-A-2: Half-breadth

449-B-1: Body plan

449-B-2: Gun deck

449-B-3: Spar deck

450-A-1: Bouyancy calculation

Sloops of War *Dale* and *Preble*, 1839

451-A-1: Sheer, half-breadth body plan

451-B-1: Outboard profile

452-A-1: Sheer, half-breadth body plan

452-B-1: Displacement curve

452-B-3: Cross section body plan

453-A-1: Deck plan

453-A-3: Bow and stern

454-A-1: Rigging

Sloop of War *John Adams*, 1826

454-A-2: Body plan

***Anchor Hoy*, 1848**

454-A-3: Profile

Steam Boat *Mount Vernon*, 1824

454-B-1: Sheer, half-breadth body plan with cross section

Draught of Gun Boat

454-B-2: Sheer, half-breadth plan

Gun Ship *Franklin*, 1815

455-A-1: Sheer, half-breadth plan and outboard profile

455-B-1: Body plan

456-A-1: Midship section

456-A-2: Bow and stern

457-A-1: Gun carriages

457-A-2: Sail plan

Packet Ship *Tuskarora*

457-B-1: Sheer, half-breadth

Packet Ship *Shenandoah*, 1840

458-A-1: Sheer, half-breadth

458-A-3: Sail plan

Sloop of War *Germantown*, 1837

459-A-1: Sheer, half-breadth plan

460-A-1: Profile

460-A-3: Sections

460-B-1: Body plan

461-A-1: Outside of planking

461-A-2: Planking

461-B-1: Tank plan

461-B-2: Deck plan

462-A-1: Gun and berth deck plans

462-A-3: Anchor

462-B-1: Storage plan

462-B-2: Mast

462-B-3: Sail plan

463-A-2: Mast

463-A-3: Gun

465-A-1: Gun carriage

465-A-3: First cutter body plan

465-B-1: Second cutter body plan

465-B-2: Stern boat body plan

465-B-3: Launch body plan

466-A-1: Quarter boat body plan

466-A-2: Sail plan, profile of launch, first cutter

Bibliography of Documents

486-B-1

466-B-1: Curve of form

Steam Ship *Mississippi*, 1841

467-A-1: Sheer, half-breadth body plans

468-A-1: Outside of plank

468-B-1: Berth deck profile

469-A-1: Gun deck

469-B-1: After orlop deck

469-B-2: Detail

469-B-3: Midsection

470-A-1: Gun arrangement

470-A-2: Gun and carriage

470-B-1: Detail of bow

471-A-1: Sail plan

471-A-2: Displacement curves

Ship of the Line *Pennsylvania*, 1837

472-A-1: Midship section

472-A-2: Inboard profile

472-B-1: Orlop deck

472-B-3: Deck plan

473-A-1: Rudder

473-A-2: Tiller

473-A-3: Carving detail

473-B-1: Stowage plans

474-A-1: Stowage plans

474-A-2: Sail plans

474-B-1: Rigging

475-A-2: Launch plan

Steam Ship *Princeton*, 1846-1848

476-A-1: Deck plans

476-B-2: Gun carriage

477-B-2: Sheer, half-breadth body

477-B-3: Midship section

478-A-1: Sail plan

478-A-2: Displacement curve

478-B-1: Details

479-A-1: Sail plan

Store Ship *Relief*, 1835

480-A-1: Body plan

480-A-2: Deck plans

480-B-2: Arch board through bulwarks

480-B-3: Stern detail

481-A-1: Windlass

481-A-3: Sail plan

481-B-1: Main mast, section

481-B-2: Fore mast, section

481-B-3: Mizzen mast, section

482-A-1: Launching ways

Light Draught Monitor *Shiloh*, 1836

483-A-1: Boilers

483-A-2: Turret

483-A-3: Pilot house

484-A-2: Turret

484-B-1: Smoke pipe

484-B-2: Bulwarks and side armor

484-B-3: Port stopper

485-A-2: Bulwarks, armor at bow

485-B-1: Turret bulkheads

485-B-2: Plan of centre keelsons keel

485-B-3: Motive engine

486-A-1: Motive engine cylinders

486-A-2: Motive engine details

486-B-1: Engine keelsons

486-B-2: Carriage for Dahlgren gun

487-A-1: Blower engines

487-A-2: Rudder, propeller and stern arrangement

487-A-3: Sleeve and stuffing box for propeller shaft

487-B-1: Propeller details and stern arrangement

487-B-2: Turret machinery detail

488-A-1: Turret engines

488-A-2: Turret engine detail

488-B-1: Turret reversing gear

488-B-3: Turret machinery detail

489-A-2: Valves for water compartment

489-A-3: Vacuum engine detail [wrought iron work]

490-A-1: Vacuum engine detail

491-A-1: Surface condenser

491-A-2: Arrangement of turret machinery

491-B-2: Valves

492-A-1: Coal bunker and bulkhead

492-A-2: Carriage for Parrott gun

492-A-3: Trunnions

492-B-1: Deck plan

492-B-2: Joinery in ward room

493-A-1: Joinery on berth deck

493-A-3: Dimpfel's blower

493-B-1: Valves

494-A-1: Quarters, berth deck

494-A-3: Bilge valves

494-B-1: Deck stanchions and braces

494-B-2: Bulkheads

494-B-3: Method of bolting deck beams

Light Draught Monitor *Shiloh*, 1863

495-A-1: Bulkheads

495-A-2: Steam stop and blow valves

495-B-1: Throttle valve and hand pump

496-A-1: Water guards and coal shutes

496-A-2: Deck light and cover

496-B-1: Water closet and pump

496-B-2: General plan

497-A-1: Cutter

497-A-2: Dinghy

497-A-3: Steering gear

497-B-3: Deck hatches

498-A-1: Ash hatches

498-A-2: Anchor hoister, chain way

498-B-1: Chain way

498-B-2: Fresh water maker and tanks

498-B-3: Standing berths

499-A-1: Gun carriage friction gear

499-A-2: Pipe arrangement

499-B-1: Shot lifter

499-B-2: General plan

500-A-1: Bell pull

500-A-2: Ventilator

500-B-1: Bulwarks and side armor

500-B-2: Bulkheads

500-B-3: Turret and pilot house bolting plates

501-A-1: Stern arrangement

501-A-2: Stiffening plates

501-A-3: Cross floors

501-B-1: Pilot house peep holes

501-B-2: Propeller

502-A-1: Turret reversing gear**502-A-3:** Anchor**502-B-1:** Deck beams**502-B-2:** Pump, detail**502-B-3:** Condenser, stiffening**503-A-1:** Turret, detail**503-A-2:** Propeller detail**503-A-3:** Brace***Medea, 1833*****504-A-1:** Half-breadth**504-B-1:** Deck plan**504-B-3:** Sail plan**505-A-1:** Displacement curve***Steam Ship Southampton, 1845*****505-A-2:** Sheer, half-breadth**505-B-1:** Midship section***Side-Wheel Steamer, Susquehanna, 1848*****506-A-1:** Sheer, half-breadth body plan**507-B-1:** Inboard profile**507-B-3:** Body plan, cross-section**508-A-1:** Midship section**508-A-2:** Cross-section at engine room**508-B-1:** Gun deck***Side-Wheel Steamer Susquehanna, 1848*****509-A-1:** Cross-section**509-A-2:** Orlop deck, 1847**509-A-3:** Inboard profile**509-B-1:** Berth deck**510-A-1:** Shell room**510-A-2:** Keelsons**510-B-1:** Engines**510-B-3:** Figurehead**511-A-1:** Launching plan***Screw Sloop of War Susquehannah, 1870*****511-B-1:** Conversion plan***Brig Washington, 1847*****512-A-1:** Outboard profile**512-A-2:** Sail plan**512-A-3:** Deck plans**512-B-1:** Sheer, half-breadth body plan***Beach Boat*****512-B-2:** Sheer, half-breadth body plan

Wright Brothers Collection

The Wright Brothers' Collection of drawings provides an interesting contrast to the other iconographic materials. The two brothers, Wilbur and Orville Wright, ran a bicycle shop. The drawings themselves are working papers, not finished presentation pieces. Most of the drawings are on heavy brown paper. Yet the drawings and the test data provide a step-by-step record of the Wright brothers' careful research and development, from the first powered flights in 1903 to the training of Army lieutenants in 1909 in College Park, Maryland.

Orville Wright deeded his and his brother's wind tunnel apparatus, model airfoils, test data and drawings of early planes to The Franklin Institute. The collection also includes airfoil models tested at McCook field during 1919, 1920 and 1921 as well as some of Orville's experimental aviation devices. These include a shaper and cutter to prepare wax airfoil models, a special scale, smoke apparatus for wind tunnel use, a bank indicator, an incidence indicator, an automatic landing device and a cypher machine (1).

Among the original drawings are those of the first successful airplane—the 1903 biplane, and

the 1904, 1905, 1907, and 1910 biplanes. Engine drawings include the 1910 motor and prints of the 1903 motor.

The drawings were conserved as part of The Franklin Institute's celebration of the 75th anniversary of the 1903 historic flight. A special exhibit was prepared in the Aviation Wing of the Science Museum. James Harrington, director of exhibits, and the Aviation Committee secured funding for the exhibit and conservation projects. Contributors included the National Endowment for the Arts, the Renschler Foundation, major airplane manufacturers, and Philadelphia-area business.

Included with the Wrights' materials are mementos of early aviation history. Photographs of Amelia Earhart and Charles A. Lindbergh have been filmed as were the photographs and newspaper clipping from the 1909 Hudson-Fulton celebration flights by Wilbur Wright and Glen Curtis. The test data were too extensive to film.

(1) See Ralph H. McClarren, "The Wright Brothers' Aeronautical Engineering Collection at The Franklin Institute, Philadelphia, Pa.," *Journal of The Franklin Institute*, 252:2 (August 1951), pp. 175-196 for a complete description of the Collection.

513-A-1 to 529-A-1

WRIGHT BROTHERS COLLECTION

513-A-1: 1903 biplane, blueprint from drawing (1928) for the National Advisory Committee for Aeronautics

515-B-1: 1904 wing and rudder propeller No. 2 horizontal motor

516-A-1: Wings, 1905

516-A-3: 1905-6 cylinder and connecting rod

516-B-1: Engine

516-B-2: Photograph of biplane

516-B-3: NACA drawing

517-A-1: 1907 wing panels

517-B-1: 1909 U.S. government machine wing panels

517-B-2: 1909 U.S. government machine chain guides

517-B-3: 1909 sectional elevation of Wright Aeroplane built by Short Brothers, England

518-A-1: 1909 plan of Wright Aeroplane top plane removed, Short Brothers Aeroplane Works, England

518-A-2: 1910 motor

519-A-2: 1910 camshaft

519-A-3: 1910 screws pitch

519-B-1: 1910 wings

520-A-1: 1910 German blueprints

526-B-1: 1901 apparatus (lift, drag, and 4 wind tunnel graphs)

528-A-1: Photographs and news clipping [n.d.]

528-A-2: 1911 Sikorsky *The Grand*

528-A-3: 1914 Curtiss Model F Boat

528-A-4: 1914 Curtiss pontoon plane

528-A-5: Charles H. Hubbell print, *Atlantic Odyssey*, 1919 flight by John Alcock

528-B-1: Photograph of early biplane on ground

528-B-2: Photograph of Amelia Earhart

528-B-3: Photograph of Charles Lindbergh

528-B-4: Biographical sketch with pictures of Charles Elvers of Baltimore, 1909-1910

529-A-1: 1903 wing, photostatic copy

INDEX TO NAMES OF INDIVIDUALS AND ORGANIZATIONS

Aero Club of America

Resolution on Aero Club of America, Jan. 25, 1912 82-A-10

Alcock, John

Charles H. Hubbell print, *Atlantic Odyssey*, 1919 flight by John Alcock 528-A-5

Aldrich, William S.

"Notes on electro-magnetic machinery"

105-D-2; 106-D-2

"On the variable action of two-coil solenoids" 106-D-2

American Association for the Advancement of Science

Prospectus for an astronomical journal, 1849 180-E-1

American Institute of Electrical Engineers

Correspondence 255-A-5

American Institute of Instruction

Walter R. Johnson, "On schools of the arts," 1835 124-D-6

American Institute of New York

American Institute of New York (correspondence, 1829 to 1859) 201-A-1

American Meteorological Society

American Meteorological Society, The metric system of weights and measures: why it should be adopted in the U.S. 144-E-12

American Philosophical Society

One hundredth anniversary announcement, 1843 171-A-5

American Society of Mechanical Engineers

F. A. Halsey, The metric system, 1902 144-F-6

"Report of the committee appointed to discuss the arguments in favor of and against the metric system," 1903 147-B-1

Association for the Exhibition of the Industry of all Nations

Association for the Exhibition of the Industry of all Nations (notice for exhibitors, 1853) 205-B-13

Bache, Alexander D.

Address to exhibition of 1842 237-C-14
General Report of the Committee, 1836 149-D-10

Report of Experiments for the Treasury Department, 1836 150-A-4

- Balch, Thomas**
Address to exhibition of 1854 245-B-12
- Ballewell, Thomas**
Sine table explanation, 1854 192-B-1
- Banes, Charles H.**
General report of the Committee on Exhibitions' Chairman 287-C-1
- Bartol, B. H.**
Report of "the Board of Engineers" to the Secretary of the Navy on the Boilers of the USS *San Jacinto*, 1868 155-A-2
- Bartol, Henry W.**
"The electric railway at Buda Pesth" 105-D-2
- Bartram, George H.**
"On a source of error in the determination of nitrates in water by the phenol sulphonic acid method" 91-B-8
- Bedell, C. H.**
"Dynamo and motor calculation" 106-D-2
- Binney, Horace**
Papers of the Joint Committee, 1817 148-F-5
- Birkinbine, John**
Commemorative exercises at the seventy-fifth anniversary of The Franklin Institute, Oct. 2 to 7, 1899 338-A-1
Letters, Sept. 1900 72-A-1
Sketch of Birkinbine's hydraulic ram 157-A-4
- Bond, George M.**
American Society of Mechanical Engineers, Report of the committee appointed to discuss the arguments in favor of and against the metric system, 1903 147-B-1
- Boyer, Charles S.**
"Analysis of 'Eggio': A preparation of the yoke of eggs" 93-B-4
- Branson, David** "Artificial refrigeration through street pipe lines from central stations"
"Artificial refrigeration through street pipe lines from central stations," David Branson, Nov. 15, 1893 345-F-2
- Breed, Mary B.**
"On phenolphthalein and methylorange as indicators" 94-C-8
"The action of magnesium upon the vapors of the alcohols and a new method of preparing allylene" 95-G-14
- Briggs, Robert**
Report of the Committee on Factors of Safety for Carrying Steam Pressures, [n.d.] 154-A-1
- Bromley, William**
Report of "the Board of Engineers" to the Secretary of the Navy on the Boilers of the USS *San Jacinto*, 1868 155-A-2
- Brooklyn Institute**
Brooklyn Institute (notice of formation, 1843; article, 1898) 203-A-1
- Brooks, David**
"The value of oil as an insulator for high voltage currents" 105-D-2
- Brown, James M.**
Reports with drawings of waterwheels, [ca. 1830] 157-A-11
- Browne, Peter A.**
Address on laying the corner stone of the hall, June 1825 199-E-3
Address to the freemen of Pennsylvania, June 1825 199-D-14
Corresponding Secretary's Letterbook, 1824-1826 198-A-1 to 200-C-5
- Bryant, A. P.**
"Investigation of a bitumen from Park County, Montana" 95-G-14
"Note on Pemberton's method of phosphoric acid determination as compared with the official methods" 95-G-14
- Bullock, Charles**
"On the preparation and properties of metallic manganese" 88-A-1
- Carbutt, John**
"The diazotype process of photographic dyeing and printing" 91-B-8
- Carhart, Henry S.**
"The theory and design of the closed-coil constant current dynamo" 108-G-2
- Carter, Oscar C. S.**
"Anthracite coal near Perkiomen Creek" 95-G-14
"Artesian wells" 94-C-8
"Artesian wells as a water supply for Philadelphia" 93-B-4
"Drilling for oil and natural gas in the vicinity of Philadelphia" 95-G-14
- Casselberry, Evans**
"On theories of water power and animal heat," 1844 172-B-1

Index by Subjects and Names

Falkenau, A.

- Chandler, Joseph R.**
Address to exhibition of 1847 *240-C-10*
- Christie, James**
American Society of Mechanical Engineers,
Report of the committee appointed to
discuss the arguments in favor of and
against the metric system, 1903 *147-B-1*
- Clarkson, Philip S.**
"The action of chlorine on Haematoxylin
and the extractive matter of logwood"
89-F-1
- Cleveland, Grover, Pres.**
Letter, Pres. Grover Cleveland's private
secretary to Mendenhall, July 12, 1894
103-A-4
- Committee on Lectures**
Reports, 1824 to 1825, Committee on
Lectures *122-B-4*
- Committee on Minerals and Geological
Specimens**
Bond deposit receipt for mineral and
geological specimens, 1848 *141-B-2*
Reports, 1850 *141-B-5*
- Copeland, Charles W.**
Report of "the Board of Engineers" to the
Secretary of the Navy on the Boilers of
the USS *San Jacinto*, 1868 *155-A-2*
- Coryell, Miers**
Report of "the Board of Engineers" to the
Secretary of the Navy on the Boilers of
the USS *San Jacinto*, 1868 *155-A-2*
- Crapm Shipbuilding Co.**
Naval architecture drawings *375-A-1* to
447-A-1
- Crew, Henry**
"Ewing's theory of induced magnetism"
105-D-2
- CSA No. 1458**
"The Hollerith electric tabulating system"
344-B-2
- Davis, Richard W.**
"A new form of megohm resistance"
105-D-2
- Day, William C.**
"Investigation of a bitumen from Park
County, Montana" *95-G-14*
"Note on Pemberton's method of
phosphoric acid determination as
compared with the official methods"
95-G-14
- Department of Treasury**
Correspondence, July 1824 to Mar. 1867
148-D-7
Report of Experiments for the Treasury
Department, 1836 *150-A-4*
Report of Experiments for the Treasury
Department, 1837 *151-A-12*
- Dietz, G.**
"High-speed photography" *346-F-2*
- Duncan, Harold M.**
"Machine substitutes for the composition of
types by hand" *347-E-3*
- Durfee, William F.**
Correspondence, William F. Durfee to
Coleman Sellers, July 31, 1891 *124-B-10*
Report of the Committee on Factors of
Safety for Carrying Steam Pressures, [n.d.]
154-A-1
- Earhart, Amelia**
Photograph of Amelia Earhart *528-B-2*
- Ecole Nationale des Mines**
1850 incoming correspondence *183-A-1*
- Electro-Magnetic Association**
Stock offering, 1837 *166-C-4*
- Elvers, Charles A.**
Biographical sketch with pictures of Charles
Elvers of Baltimore, 1909-1910 *528-B-4*
- Evans, Cadwallder**
Remarks on steam engine boiler explosions,
1830 *148-F-5*
- Evans, Owen**
Address to exhibition of 1847 *239-F-4*
- Everett, W. E.**
Report of "the Board of Engineers" to the
Secretary of the Navy on the Boilers of
the USS *San Jacinto*, 1868 *155-A-2*
- Falkenau, A.**
"The smoke nuisance and its regulation,
with special reference to the condition
prevailing in Philadelphia — improved
furnaces and mechanical stokers," *348-C-3*

Ferree, Barr

"Institute Organization: The Plan and Scope of the Brooklyn Institute and Its Application to Other Cities," 1898 203-A-1

Flagg, L. C.

Composition book of international electrical exhibition newspaper clippings and advertising 252-A-3

Ford, William H., Dr.

"The smoke nuisance and its regulation, with special reference to the condition prevailing in Philadelphia — improved furnaces and mechanical stokers" 348-C-3

Fraleigh, Frederick

Address to exhibition of 1844 238-E-6
Commemorative exercises at the fiftieth anniversary of The Franklin Institute, Feb. 6, 1874 337-A-1

Frankel, Lee K.

"Electrolytic separations" 88-A-1; 89-F-1
"Gelatinous silver cyanide" 94-C-8
"The electrolysis of the metallic sulphocyanides" 91-B-8
"The electrolytic method applied to mercury separation from copper" 88-A-1
"The electrolytic separation of cadmium from zinc" 88-A-1
"The oxidation of metallic arsenides by the electric current" 91-B-8

Franklin Institute of New Haven

Franklin Institute of New Haven (outline of structure, goals [ca. 1840]) 204-B-1

Franklin Institute of Rochester, N.Y.

Franklin Institute of Rochester, N.Y. (Schedule of examinations and promotional materials, correspondence, 1909-1910) 203-C-4

Fulton Institute

Fulton Institute (exhibition announcement; correspondence, 1859) 205-D-11

Garrigues, Isaac B.

Address of the Committee of Instruction on the High School Department, [n.d.] 127-E-12

Garrison, F. Lynwood

"The smoke nuisance and its regulation, with special reference to the condition prevailing in Philadelphia — improved furnaces and mechanical stokers" 348-C-3

Gernung, Nelson H.

"Recent improvements in d'Arsonval galvanometers" 106-D-2

Gill, John L., Jr.

"Screw threads" 343-A-3

Gilpin, Henry D.

Address to exhibition of 1856 246-B-8

Greene, William H.

"A new method of reducing metallic oxides" 94-C-8
"A new process for the manufacture of manganese on the commercial scale" 94-C-8
"Alloys of sodium and lead" 89-F-1
"For sealing of volatile liquids in glass tubes" 88-A-1
"On aceto-metanitrobenzoic anhydride" 88-A-1
"On some derivatives of lapachic acid" 89-F-1
"On the occurrence of lapachic acid in bethabarra wood" 88-A-1

Grimshaw, Robert

"Abstract of 'influence of pulley diameter on the driving power of flat belts'" 342-F-2
"Percussion rock drills" 342-D-2

Haines, Reuben

"A remarkable artesian well water" 95-G-14
"Analysis of an artesian well water" 91-B-8
"Examination of spring waters in Fairmount Park" 95-G-14
"On local standards in water analysis with special reference to Philadelphia and its vicinity" 91-B-8
"On the ammonia process of water analysis" 91-B-8
"On the percentage of iodine absorbed by lard oil by the Hubl method" 91-B-8
"On the use of galvanized iron for artesian wells and for the conveyance of drinking water" 89-F-1

Halsey, F. A.

The metric system 144-B-2
The metric system, 1902 144-F-6

Hamilton, William H.

Waterwheel investigation subscription book 156-D-5

Index by Subjects and Names

India Rubber Society

Harding, George

Address to exhibition of 1853 244-A-6

Haupt, Lewis M.

"The road movement" 345-C-2

Henry, Joseph

Joseph Henry letters, Nov. 8, 9, 21, and Dec. 6, 1859 98-B-1

Herbert, L.

Letter on steam engine boiler explosions, Oct. 1830 148-F-5

Hering, Carl

"A new form of standard cell" 105-D-2

"Ampere-centimetre, a measure of electromagnetism" 106-D-2

"Notes on recent developments in electricity abroad" 108-G-2

Hewood, Benjamin

Address to the Mechanics, Artisans, etc., Manchester, Mar. 1825 199-E-10

Heyl, Paul R.

"On the speed of the invisible portions of the spectrum" 353-A-3

Hibbard, William C.

Report of "the Board of Engineers" to the Secretary of the Navy on the Boilers of the USS *San Jacinto*, 1868 155-A-2

Hickernell, L. F.

"Abstract of the Institute and Philadelphia, 1884" 255-A-7

Himes, Charles F.

Commemorative exercises at the seventy-fifth anniversary of The Franklin Institute, Oct. 2 to 7, 1899 338-A-1

Hoadley, George A.

Commemorative exercises at the seventy-fifth anniversary of The Franklin Institute, Oct. 2 to 7, 1899 338-A-1

Hooker, Samuel C.

"A rapid colorimetric method of determining nitrates in potable waters" 88-A-1

"Note on the compound of pyrrol with picric acid" 89-F-1

"On some derivatives of lapachic acid" 89-F-1

"On the constitution of lapachic acid and its derivatives" 88-A-1

"On the detection of Falhberg's saccharine" 88-A-1

"On the occurrence of lapachic acid in bethabarra wood" 88-A-1

"On the present condition of the Philadelphia water supply" 88-A-1; 89-F-1

"On the relations existing between carbazol and pyrrol" 88-A-1

"Rapid colorimetric method for the estimation of nitrates in natural waters" 88-A-1

Hoskin, John

"A rough-and-ready dynamometer for small motors" 105-D-2

Hough, Oliver

"Salts of p-bromo-m-nitrobenzoic acid" 91-B-8

"The iodation of p-bromobenzoic acid" 91-B-8

Houston, Edwin J.

"A graphic representation of the magnetic field" 106-D-2; 344-E-3

"An early conception of the magnetic field" 106-D-2

"Artificial rain-making" 105-D-2

"Cerebral radiation" 106-D-2

"Charles A. Coulomb" 108-G-2

Commemorative exercises at the seventy-fifth anniversary of The Franklin Institute, Oct. 2 to 7, 1899 338-A-1

"Is actinism a species of electrolysis?" 105-D-2

"Some additional notes on the graphic representation of magnetic fields" 106-D-2; 345-A-2

"Some curiosities in early electrotherapeutics" 106-D-2

"The physiological effects of alternating currents of high frequency" 106-D-2

"The Roentgen rays" 347-A-2

Houston, S. F.

Letter declining membership on Board of Managers, July 1900 72-A-1

Hubbell, Charles H.

Charles H. Hubbell print, *Atlantic Odyssey*, 1919 flight by John Alcock 528-A-5

Hungary Mining and Geological

Millennial-Congress

Invitation to attend congress, Feb. 1896 70-A-1

India Rubber Society

1833 incoming correspondence 160-B-12

Ingersoll, Joseph R.

Ingersoll, Joseph R.

Address to exhibition of 1848 *241-A-10*

Ingham, S. D.

Letter on steam engine boiler explosions,
Oct. 1830 *148-F-5*

Isherwood, B. F.

Report of "the Board of Engineers" to the
Secretary of the Navy on the Boilers of
the USS *San Jacinto*, 1868 *155-A-2*

Ives, F. E.

"Prof. Lippmann's heliochromy" *91-B-8*

Jennings, W. N.

"Jove's autograph" *105-D-2*

Johnson, Walter R.

"Address on mechanics and natural
philosophy" *124-C-1*

"On schools of the arts" *124-D-6*

Report of Experiments for the Treasury
Department, 1837 *151-A-12*

Joint Committee of Meetings and Publications

Report, 1883 *61-A-1*

Kansas State Weather Service

Reporting forms *99-D-10*

Kebler, Lyman F.

"Notes on the examination of beeswax"
94-C-8

"On the interaction of borax, carbonates,
and polyhydric alcohols; also on the
composition of borax" *95-G-14*

Keiser, Edward H.

"On the synthesis of fumaric acid" *89-F-1*

"The action of magnesium upon the vapors
of the alcohols and a new method of
preparing allylene" *95-G-14*

Keller, Harry F.

"On diacetyl and some of its derivatives"
88-A-1

"On kobellite from ouray, collection and
chemical composition of this species"
88-A-1

Index by Subjects and Names

"On the analysis of American refined
copper" *95-G-14*

"On the compound C₂₁Cl₂₆" *88-A-1*

"Some recent contributions to our
knowledge of metallic reducing agents"
95-G-14

"The action of hydrogen sulphide gas upon
metallic amines" *89-F-1*

"The electrolytic method as applied to
palladium" *89-F-1*

Kelly, William D.

Address to exhibition of 1852 *243-A-2*

Kennelly, A. E.

Commemorative exercises at the
seventy-fifth anniversary of The Franklin
Institute, Oct. 2 to 7, 1899 *338-A-1*

"The Roentgen rays" *347-A-2*

Kent, William

American Society of Mechanical Engineers,
Report of the committee appointed to
discuss the arguments in favor of and
against the metric system, 1903 *147-B-1*

"Weighing machines" *343-F-2*

Kentucky Mechanics Institute

Kentucky Mechanics Institute (exhibition
notices, 1854, 1855, and 1856;
correspondence, 1856 and 1859 *206-C-12*

Kirchhoff, Charles

Commemorative exercises at the
seventy-fifth anniversary of The Franklin
Institute, Oct. 2 to 7, 1899 *338-A-1*

Kitson, Arthur

"The smoke nuisance and its regulation,
with special reference to the condition
prevailing in Philadelphia — improved
furnaces and mechanical stokers" *348-C-3*

Koenig, George A.

"Is sulphuric hydrate volatile at the ordinary
temperature of the air" *91-B-8*

Kolkin, Nils

Chemistry of ethereal matter, 1884 *251-C-1*

Lawber, John C.

Reports with drawings of waterwheels, [ca.
1830] *157-A-11*

Leeds Mechanics Institution and Literary Society

- Letter and materials on instructional program *177-B-1*
- Lehman, William**
Papers of the Joint Committee, 1817 *148-F-5*
- Lenher, Victor**
"The action of ammonia gas upon molybdenyl chloride" *94-C-8*
- LeVan, W. Barnet**
Report of the Committee on Factors of Safety for Carrying Steam Pressures, [n.d.] *154-A-1*
- Lewis, J. O.**
"America's petroleum problems" *353-E-3*
- Lewis, Wilfred**
Commemorative exercises at the seventy-fifth anniversary of The Franklin Institute, Oct. 2 to 7, 1899 *338-A-1*
- Lindbergh, Charles A.**
Photograph of Charles Lindbergh *528-B-3*
- Lloyd, Herbert**
"The chloride electrical storage battery" *108-G-2*
- London Provident Institution**
Records transmitted to Library of Congress by Franklin Institute, 1843 *171-A-5*
- Long, S. H.**
"On the structure and management of steam engine boilers," July 1830 *148-F-5*
- Louis, O. T.**
"Errors in the determination of areas from measured diameters" *106-D-2*
- Maas, Phillip**
"The atomic weight of molybdenum" *94-C-8*
- MacFarlane, William W.**
"The action of chlorine on Haematoxylin and the extractive matter of logwood" *89-F-1*
- Maclurian Lyceum of Arts and Sciences**
Maclurian Lyceum of Arts and Sciences (report of transactions, 1830) *205-C-1*
- Mahon, R. W.**
"Slag cement experiments" *95-G-14*
- Mailliau, Ernest**
"The methods of testing fats and oils" *94-C-8*
- Maryland Academy of Science and Literature**
Appeal for funds, 1836 *165-C-9*
- Maryland Institute**
Maryland Institute (exhibition notice, 1850, 1853 to 1856; correspondence, 1847, 1848, 1852, 1853, 1857, 1859; constitution, 1847) *206-D-12*
- Maryland Institute for the Promotion of the Mechanic Arts**
Maryland Institute for the Promotion of the Mechanic Arts, 1857 (tenth exhibition notice, 1857) *203-C-2*
- Mason, William P.**
"Notes on some cases of drinking water and disease" *91-B-8*
- Massachusetts Charitable Mechanics Association**
Massachusetts Charitable Mechanics Association (correspondence, 1837, 1840, 1844, 1859; exhibition notices, 1839, 1841, 1844, 1847, 1853) *207-A-10*
1837 incoming correspondence *166-C-4*
- Matos, Louis J.**
"The application of electricity to the bleaching of textile fibres" *346-B-2*
- McCook, Henry C.**
Commemorative exercises at the seventy-fifth anniversary of The Franklin Institute, Oct. 2 to 7, 1899 *338-A-1*
- Melville, George W.**
Modern warship as combining in itself the highest results of skill, ingenuity, and scientific knowledge *338-A-1*
- Mendenhall, T. C.**
Commemorative exercises at the seventy-fifth anniversary of The Franklin Institute, Oct. 2 to 7, 1899 *338-A-1*
Letter, Mendenhall to Owens, May 29, 1914 *102-E-2; 102-E-14*
Letter, Pres. Grover Cleveland's private secretary to Mendenhall, July 12, 1894 *103-A-4*
- Merrick, J. Vaughn**
Report of "the Board of Engineers" to the Secretary of the Navy on the Boilers of the USS *San Jacinto*, 1868 *155-A-2*
- Merrick, Samuel V.**
Address of the Committee of Instruction on the High School Department, [n.d.] *127-E-12*

Metropolitan Mechanics Institute

Metropolitan Mechanics Institute

Metropolitan Mechanics Institute
(correspondence 1852; exhibition notices,
1852) 206-B-6

Miller, Fred J.

American Society of Mechanical Engineers,
Report of the committee appointed to
discuss the arguments in favor of and
against the metric system, 1903 147-B-1

Mitchell, D. M.

Sine table and remarks, 1853 189-E-3

Mitchell, John K.

Address of the Committee of Instruction on
the High School Department, [n.d.]
127-E-12

"Lecture on some of the means of elevating
the character of the working classes"
125-A-2

Moore, James

Report on the standard Troy pound by U.S.
Mint, 1883 138-C-8

Morton, Henry

Commemorative exercises at the fiftieth
anniversary of The Franklin Institute, Feb.
6, 1874 337-A-1

National Institute

Medical Department Circular, 1843 171-A-5

National Institute of France

Report on the measure of the meridian of
France to the National Institute of France
138-C-1

National Magazine and Industrial Record

Proposed publication, 1845 173-C-8

New Jersey State Weather Service

Reporting forms 99-D-9

New York Electrical Society

New York Electrical Society (constitution,
by-laws, and membership, 1912-1913)
205-A-1

New York Mechanic and Scientific Institution

New York Mechanic and Scientific
Institution (charter and by-laws;
correspondence, 1831 to 1852) 202-B-1

Nicolls, G. A.

Railroad switch model, 1845 173-C-8

Index by Subjects and Names

Norris, G. L.

"A rapid method for phosphorus in iron and
steel, modified from a method proposed by
Dr. Thomas M. Drown" 88-A-1

Northrup, E. F.

"Some principles that must be observed in
order to make a good closed-circuit
battery and a new portable dry cell
described in which these principles are
applied" 108-G-2

Oberholtzer, Vickers

"Action of the haloid acids in gas form
upon molybdic acid" 94-C-8

Office of the Coast and Geodesic Survey

Legal Units of Electric Measure in the U.S.,
1894 102-E-10

Letter, Mendenhall to Owens, May 29, 1914
102-E-2

Ohio Mechanics Institute

Ohio Mechanics Institute (correspondence,
1834, 1839; exhibition notice, 1854 and
1857) 205-E-13

Orr, Hector

Address to the international electrical
exhibition 278-G-3

Letter to Optical Section, Mar. 27, 1872
81-C-2

Outerbridge, Alexander E., Jr.

"A fourth state of matter" 342-A-3

"The smoke nuisance and its regulation,
with special reference to the condition
prevailing in Philadelphia — improved
furnaces and mechanical stokers" 348-C-3

Owens, R. B.

Letter, Mendenhall to Owens, May 29, 1914
102-E-2; 102-E-14

Palmer, T. Chalkey

"On the ash of tillandsia usneoids" 88-A-1
"The testing of logwood extracts" 88-A-1

Paris Academy of Inventors

Paris Academy of Inventors
(correspondence and information,
1893-1894) 204-C-1

Patent Office

Letters on publication of an index to patents
extensions 180-E-1

Letters on salaries and appointments of
patent examiners and examiner assistants
185-A-1

Paterno, E.

"On lapachic acid and its derivatives"
88-A-1

Patterson, Robert M.

Address of the Committee of Instruction on
the High School Department, [n.d.]
127-E-12

Address to exhibition of 1843 238-A-10

Pemberton, Henry, Jr.

"An apparatus for heating substances in
glass tubes under pressure" 91-B-8

"Analysis of a chromite" 91-B-8

"On the determination of phosphoric acid"
95-G-14

"The determination of phosphoric acid by
the titration of the yellow precipitate with
standard alkali" 94-C-8

Pennington, John H.

Steam-kite, or inclined plane for navigating
the air, drawing and correspondence, 1838
166-C-12

Pennsylvania State Weather Service

Continuing legislation 99-E-3; 99-E-7

"Franklin Institute letter to county
agricultural societies" 99-E-1

Reporting forms 99-D-8

"Signal Office letter on operations" 99-E-2

Philadelphia Board of Health

"The smoke nuisance and its regulation,
with special reference to the condition
prevailing in Philadelphia — improved
furnaces and mechanical stokers," series of
presentations and discussions, Apr. 21-Oct.
20, 1897 348-C-3

Philadelphia Phonographic Society

Constitution 81-D-10

Membership list 81-D-8

Report, [n.d.] 81-D-2

Pike, Clayton W.

"A new accumulator plate" 105-D-2

"Constant shunt method for the
measurement of large continuous currents"
106-D-2

"Effect of external magnetic disturbances on
Weston instruments" 106-D-2

Pittsburgh Institute of Arts and Sciences

Pittsburgh Institute of Arts and Sciences
(correspondence, 1836) 205-D-1

Pittsburgh Institute of Arts and Sciences
(correspondence, 1839) 205-E-3

Pittsburgh Mechanics Institute

Pittsburgh Mechanics Institute (constitution
and officers; correspondence, n.d.) 205-E-5

Pittsburgh Mechanics Institute (letter, 1830)
205-D-2

Pope, Ralph W.

Commemorative exercises at the
seventy-fifth anniversary of The Franklin
Institute, Oct. 2 to 7, 1899 338-A-1

Quinn, John F.

Section on Engineering and Naval
Architecture, letter, Sept. 27, 1893 82-A-2

Ralston, Ashbel G.

Address of the Committee of Instruction on
the High School Department, [n.d.]
127-E-12

Replogle, Mark A.

"Speed government in water-power plants"
351-A-3

Richards, Joseph W.

Commemorative exercises at the
seventy-fifth anniversary of The Franklin
Institute, Oct. 2 to 7, 1899 338-A-1

"On the heat of formation of fluorides"
91-B-8

"The resistance to corrosion of some light
aluminum alloys" 95-G-14

Richmond Athenaeum

Richmond Athenaeum (correspondence,
1830 and 1831) 206-A-9

Rigling, Alfred

Brief notes on the early history of
photography in Philadelphia 118-A-1

Roberts, Solomon W.

Roberts, Solomon W.

Address to exhibition of 1846 239-D-6

Roberts, Thomas P.

"The smoke nuisance and its regulation, with special reference to the condition prevailing in Philadelphia — improved furnaces and mechanical stokers" 348-C-3

Roebling, John A.

Pittsburgh suspension aqueduct, 1845
173-C-8

Rogers, Robert E.

Commemorative exercises at the fiftieth anniversary of The Franklin Institute, Feb. 6, 1874 337-A-1

Obituary, Oct. 1885 62-A-1

Ronaldson, James

Address of the Committee of Instruction on the High School Department, [n.d.]
127-E-12

Rordinella, L. F.

"An experimental analogue for direction of induced currents" 105-D-2

Roney, William R.

"The smoke nuisance and its regulation, with special reference to the condition prevailing in Philadelphia — improved furnaces and mechanical stokers" 348-C-3

Rowland, Arthur J., Jr.

"Mistakes in the rating of incandescent lamps" 351-F-3

Sayen, H. Lyman

"Recent improvements in x-ray tubes" 351-D-2

Schutze, L.

Report of the Committee on Factors of Safety for Carrying Steam Pressures, [n.d.]
154-A-1

Scott, E. Alexander

Letter, Dec. 16, 1885 81-C-9

Seal, Alfred N.

"Utah Ozokerite" 89-F-1

Sellers, Coleman

Address to exhibition of 1874 249-G-4
Commemorative exercises at the fiftieth anniversary of The Franklin Institute, Feb. 6, 1874 337-A-1

Commemorative exercises at the seventy-fifth anniversary of The Franklin Institute, Oct. 2 to 7, 1899 338-A-1

Index by Subjects and Names

Correspondence, William F. Durfee to Coleman Sellers, July 31, 1891 124-B-10

Senate of the U.S.

Bill for the regulation of the boilers and engines of vessels propelled in whole or in part by steam, 1836 149-G-10

Signal Office

"Pennsylvania State Weather Service" operations 99-E-2

Smith, Benjamin S.

Against adopting the metric system 144-A-2

Smith, Daniel B.

Address of the Committee of Instruction on the High School Department, [n.d.]
127-E-12

Smith, Edgar F.

"Action of the gas from As_2O_3 and HNO_3 upon p-oxybenzoic acid" 88-A-1

"Action of the haloid acids in gas form upon molybdcid acid" 94-C-8

"Derivatives obtained from monochlorodinitriphenol and bases of the aromatic series" 88-A-1

"Electrolytic separations" 88-A-1; 89-F-1

"On the compound $\text{C}_2\text{Cl}_2\text{I}_6$ " 88-A-1

"Oxidations by means of the electric current" 88-A-1

"The action of ammonia gas upon molybdenyl chloride" 94-C-8

"The action of hydrogen sulphide gas upon metallic amines" 89-F-1

"The atomic weight of molybdenum" 94-C-8

"The electrolytic determination of gold" 91-B-8

"The electrolytic determination of mercury" 91-B-8

"The electrolytic method applied to mercury separation from copper" 88-A-1

"The electrolytic method applied to rhodium" 91-B-8

"The electrolytic method as applied to palladium" 89-F-1

"The electrolytic separation of cadmium from zinc" 88-A-1

"The oxidation of sulphides by means of the electric current" 89-F-1

"Vanadium in caustic potash" 88-A-1

Smith, William

Papers of the Joint Committee, 1817
148-F-5

Smithsonian Institution

Correspondence on establishment of a meteorological observation system, 1848
178-D-6

Societe Polytechnique

1838 incoming correspondence *166-C-12*

Society for Development of Mineral Resources of the U.S.

Society for Development of Mineral Resources of the U.S. (announcement of formation, 1848) *205-D-10*

Spangler, H. W.

"The smoke nuisance and its regulation, with special reference to the condition prevailing in Philadelphia — improved furnaces and mechanical stokers" *348-C-3*

Spencer, Thomas

"Some interesting peculiarities of the alternating arch lamp" *108-G-2*

St. Mark's Workingmen's Club and Institute

St. Mark's Workingmen's Club and Institute (advertising, [n.d.]) *205-D-5*

Stevens, Thaddeus

Thaddeus Stevens, Speech in favor of establishment of a school of arts, Mar. 10, 1838 *130-A-8*

Stradling, George F.

"The migration of the ions" *108-G-2*

Strode, Joseph C.

"Plan for calculating the curve for driving pipe of a ram, and by which that at Girard College was calculated," Jan. 1848 *157-A-5*

Suplee, H. H.

"The smoke nuisance and its regulation, with special reference to the condition prevailing in Philadelphia — improved furnaces and mechanical stokers" *348-C-3*

Terne, Bruno

"A contribution to Pemberton's volumetric method for phosphoric acid determination" *94-C-8*

"Notes on iron in bone-black" *93-B-4*

"Preservaline" a new preservative for meat *91-B-8*

"Report of the proceedings of the ninth annual meeting of official agricultural chemists, Washington DC, Aug. 25-27, 1892" *93-B-4*

"The utilization of garbage" *94-C-8*

"The utilization of the by-products of the coke industry" *91-B-8*

Thomson, Elihu

"Thoughts on cosmical electricity" *108-G-2*

Thorne, William H.

Intermediate Course in Mechanical Drawing, 1891, (textbook) *126-E-11*

Thruston, Robert H.

Commemorative exercises at the seventy-fifth anniversary of The Franklin Institute, Oct. 2 to 7, 1899 *338-A-1*

Thurberg, Henry

Letter, Pres. Grover Cleveland's private secretary to Mendenhall, July 12, 1894
103-A-4

Trimble, Henry

"Chestnut-bark tannin" *93-B-4*

Troth, Henry

Address of the Committee of Instruction on the High School Department, [n.d.]
127-E-12

Turner, Ernest

"Ozone" *99-C-9*

Union Agriculturist Society

Prospectus for vol. 3 of periodical, 1843
171-A-5

U.S. Mint

Report on the standard Troy pound by U.S. Mint, 1883 *138-C-8*

Vauclain, Samuel M.

"The smoke nuisance and its regulation, with special reference to the condition prevailing in Philadelphia — improved furnaces and mechanical stokers" *348-C-3*

Vaux, George

Papers of the Joint Committee, 1817
148-F-5

Vaux, Robert

Address of the Committee of Instruction on the High School Department, [n.d.]
127-E-12

Vaux, Robert

Papers of the Joint Committee, 1817
148-F-5

Virginia Mechanics Institute

Virginia Mechanics Institute (exhibition
notice, 1854) *206-A-14*

von Strombeck, Hans

"Additional notes on the composition of the
liquid ammonia of the trade, etc." *93-B-4*

"On some constants of ammonia" *89-F-1*

"On the composition of the liquid ammonia
of the trade and how to manufacture liquid
ammonia of really 99.995 percent" *93-B-4*

"On the specific heat of brines of different
specific gravity" *93-B-4*

"On the use of oil in ammoniac gas
compressors and its influence on the
efficiency of the compressors" *93-B-4*

"Supplement to the determination of the
heat of evaporation, etc. of liquid
ammonia" *91-B-8*

Wahl, William

"A new method of reducing metallic oxides"
94-C-8

"A new process for the manufacture of
manganese on the commercial scale"
94-C-8

"Alloys of sodium and lead" *89-F-1*

"On the electro-deposition of platinum"
89-F-1

Walter, Williams

"Underground conduit for electrical wires"
102-C-1

War Department

"Pennsylvania State Weather Service"
operations *99-E-2*

Weather Bureau

Letter from Weather Bureau, USDA, 1892
99-E-5

Wheeling Mechanics Institute

Wheeling Mechanics Institute
(correspondence, 1834) *206-B-4*

Whitehead, Cabell

"An improved method of determining small
percentages of silver and gold in base
metals, mattes, etc." *93-B-4*

"The use of cadmium in assaying gold
bullion" *91-B-8*

Index by Subjects and Names

Wiley, Harvey W.

Commemorative exercises at the
seventy-fifth anniversary of The Franklin
Institute, Oct. 2 to 7, 1899 *338-A-1*

Williams, J. S.

"Proposal for publishing a practical treatise
on laying out and constructing
M'adamized roads" *164-A-1*

Williams, W. J.

"Comments on the determination of
phosphoric acid by titration of the "yellow
precipitate" as described by Mr. Henry
Pemberton, Jr." *94-C-8*

Willyoung, Elmer C.

"Some new apparatus for the most exact
comparison and adjustment of resistance
standards and the determination of
temperature coefficients" *106-D-2*

Willyoung, Elmer G.

"A new ballistic galvanometer" *106-D-2*

"Resistance standards: their manufacture
and adjustment" *106-D-2*

Wilson, William P.

Commemorative exercises at the
seventy-fifth anniversary of The Franklin
Institute, Oct. 2 to 7, 1899 *338-A-1*

Winand, Paul A. N.

"On polyphased currents" *106-D-2*

Wise, Prof.

"Nimbus or storm clouds" *99-C-3*

Wright, William

Report of "the Board of Engineers" to the
Secretary of the Navy on the Boilers of
the USS *San Jacinto*, 1868 *155-A-2*