



Smithsonian
National Museum of American History
Kenneth E. Behring Center

Uriah A. Boyden Papers

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Kimberly Kennedy

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Collection Overview

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| Repository: | Archives Center, National Museum of American History |
| Title: | Uriah A. Boyden Papers |
| Identifier: | NMAH.AC.0982 |
| Date: | 1806-1879 (bulk 1830-1879) |
| Extent: | 21 Cubic feet |
| Creator: | Boyden, Uriah A. (Uriah Atherton), 1804-1879 Francis, Joseph Sidney Schultze, Bernhard |
| Language: | English Some materials are in French, German, and Greek and some have been translated from French and German into English. |
| Summary: | Papers of Uriah A. Boyden (1804-1879), a Boston civil and mechanical engineer and the inventor of the Boyden turbine. Materials include correspondence, notes, calculations, articles, notebooks, legal documents, financial documents, patents and patent assignments, design drawings, newspaper clippings, pamphlets, business cards, and a print of a daguerreotype. |

Administrative Information

Acquisition Information

Unknown.

Provenance

Transferred to the Archives Center from the Division of Work and Industry, 2008.

Processing Note

Processed by Kimberly Kennedy (intern), August, 2010; supervised by Alison Oswald, archivist.

Preferred Citation

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Administrative/Biographical History

Civil and mechanical engineer and multi-faceted scientist, Uriah Atherton Boyden was born on February 17, 1804 in Foxborough, Massachusetts. His father Seth Boyden (1764-1849) was a farmer and blacksmith and invented a machine to split leather (Reynolds 2010). His brother Seth Boyden (1788-1870) was a noted inventor in Newark, New Jersey, and in 1825 Boyden worked for him in a "leather and sheepskin bookbinding business" (Reynolds 2010). Boyden moved back to Massachusetts in 1828 and worked with James Hayward on surveys for the Boston and Providence Railroad, and with Loammi Baldwin on a dry dock for the Charlestown Navy Yard (now Boston Navy Yard) (Reynolds 2010). In the 1830s he opened his own engineering practice and worked on mills in the growing industrial center of Lowell, Massachusetts and was the chief engineer from 1836-1838 on the Nashua and Lowell Railroad. He designed a hydraulic power system for the Amoskeag Manufacturing Company in Manchester, New Hampshire around 1840 (American Society of Mechanical Engineers 1975, 5).

Boyden is best known for inventing the Boyden turbine, "the first turbine to be manufactured in quantity in the United States" (*American Society of Mechanical Engineers* 1975, 1). Boyden developed this turbine around 1844 while working for the Appleton Company in Lowell, Massachusetts (*American Society of Mechanical Engineers* 1975, 5). Boyden improved the efficiency of the Fourneyron outward flow turbine by "providing a conical approach passage for the incoming water... providing guide vanes in the outlet passages and by adding a submerged diffuser" (*American Society of Mechanical Engineers* 1975, 2). Boyden assigned his patent rights to a number of mills and manufacturing companies in New England and provided them with plans and specifications for turbines, although he did not oversee construction.

The Boyden turbine was superseded in 1849 by the more efficient inward flow Francis turbine, developed by James B. Francis with Boyden's assistance (*American Society of Mechanical Engineers* 1975, 2-3). The Francis turbine is now used throughout the world (Reynolds 2010).

After 1850, Boyden focused on scientific pursuits, including chemistry, physics, and meteorology. His other interests included the causes of fires in Boston, tobacco's effect on people's health, and mental illness in Europe and the United States. However, he rarely published the results of his research (Reynolds 2010). In 1874, Boyden "deposited \$1,000 with the Franklin Institute of Philadelphia to be awarded to any resident of North America who should determine by experiment whether light and other physical rays are transmitted at the same velocity" (*American Society of Mechanical Engineers* 1975, 5). No one has claimed the prize. Boyden died on October 17, 1879 in Boston. In his will, he bequeathed approximately \$250,000 to Harvard University, which it used to build an observatory in Peru (Reynolds 2010). The Boyden Observatory is now located in South Africa.

Reference List

1975. The 102-inch Boyden Hydraulic Turbines at Harmony Mill No. 3, Cohoes, New York. *The American Society of Mechanical Engineers*. <http://files.asme.org/ASMEORG/Communities/History/Landmarks/5507.pdf>, (accessed 18 July 2010).

Reynolds, Terry S. 2010. Boyden, Uriah Atherton. *American National Biography Online*. Oxford University Press. <http://www.anb.org/articles/13/13-00178.html> (accessed 18 July 2010).

Scope and Content

This collection documents the activities of Uriah Atherton Boyden (1804-1879), a Boston civil and mechanical engineer. The papers cover the span of Boyden's life, but the bulk of the papers date from between 1830 and 1879. The materials relate to his professional engineering life, including his work as an engineer for the Nashua and Lowell Railroad Corporation and his work with turbines at New England mills and manufacturing companies. The collection also contains papers that illustrate his scientific interests, including sound, meteorology, chemistry, and physics. Materials include correspondence, notes, calculations, articles, notebooks, legal documents, financial documents, patents and patent assignments, design drawings, newspaper clippings, pamphlets, business cards, and a print of a daguerreotype.

Series 1, Correspondence, 1823-1879, consists of three subseries: Subseries 1, Outgoing Correspondence, 1830-1879; Subseries 2, Incoming Correspondence, 1823-1879; and Subseries 3, Miscellaneous Correspondence, 1825-1879. The bulk of the series is comprised of letters, although some telegrams are included. The majority of Boyden's letters discuss his business dealings and scientific interests, but some correspondence is related to family matters. Family correspondents include his brothers Seth Boyden (1788-1870), William Pitts Boyden, Otis Boyden, Benjamin F. Boyden, and Alexander Boyden (1791-1881); his sisters Sarah Boyden (d. 1834) and Sabra Smith; and his parents Seth (1764-1840) and Susanna Boyden. He also corresponded with his niece Susan Boyden Burnet and sister-in-law Abigail Boyden. Subjects discussed include Seth Boyden's illness, death, and will in 1840 and Sarah Boyden's death in 1834.

Correspondence from the 1830s discusses the construction of the dry dock at the Charlestown Navy Yard, Massachusetts; experiments conducted at the Boston and Roxbury Mill Dam; Boyden's work as Chief Engineer for the Nashua and Lowell Railroad Corporation and his subsequent lawsuit against the Nashua and Lowell Railroad Corporation over a pay dispute; the employment of assistants; and the construction of a mill at the Amoskeag Manufacturing Company.

Frequent correspondents include William Livingston, who was deposed in Boyden's lawsuit of the Nashua and Lowell Railroad Company; F. George Stark of Amoskeag Village; John Jacques of Worcester, Massachusetts; R. Read of Amoskeag Manufacturing Company; and Ezekial Albert Straw (1819-1882), a civil engineer and agent for the Amoskeag Manufacturing Company and the governor of New Hampshire from 1872-1874. Correspondence from the 1840s is primarily about turbines. Subjects include the development of the Boyden Turbine at the Lowell Appleton Company and Boyden's patents (US Patents 5,068, 5,090, 5,114, 10,026, and 10,027).

Other topics include the Merrimack Manufacturing Company's new mill; the Stark Company's turbine; turbine pits for the Merrimack Company's Picking House; Boyden's design for a turbine built at the Lowell Machine Shop and used at Tilestons & Hollingsworth Upper Mill; and requests for books. During this period, Boyden sent letters to various manufacturing companies and mills, informing them he would be willing to sell his patent rights for turbine improvements and provide plans and specifications, although he would not oversee the construction of turbines. Recipients of these letters include hydraulic engineer James B. Francis, P. T. Jackson, treasurer of the Proprietors of Locks and Canals; T. G. Cary, treasurer of the Appleton Company; John Avery, agent of the Hamilton Manufacturing Company; Alexander Wright, agent of the Lowell Manufacturing Company; Charles T. Storrow, treasurer of the Essex Company and the Atlantic Cotton Mills; R. Read, agent of the Amoskeag Manufacturing Company; Amos A. Lawrence, treasurer of Salmon Falls Manufacturing Company; John Mixer, treasurer of the Suncook Manufacturing Company; and William Dwight, treasurer of the Saco Water Power Company.

Letters relating to the Atlantic Cotton Mills turbine design, testing, and lawsuit comprise a portion of the correspondence from the late 1840s and 1850s. Other correspondence from the 1850s includes letters to and from Boyden's employee Norman W. Stearns, who traveled to California and Australia; discussion of the testing of a turbine at the Hamilton Manufacturing Company Mills at Lowell; an extract

from a report on the power derived from the tides at the Boston and Roxbury Mill Dam; a letter from the Smithsonian Institution encouraging Boyden to publish his research on turbines; and the difficulties with turbine experiments at the Nashua Manufacturing Company's mills. Boyden continued to offer his patent rights to various companies, including James T. Ames, agent of the Ames Manufacturing Company, and Ezekial Albert Straw, agent of the Amoskeag Manufacturing Company.

Some letters were written by assistant Edward Sawyer on behalf of Uriah Boyden. Letters from the 1860s include Boyden's correspondence with the Franklin Institute in Philadelphia concerning the prize he created for any resident of North America who could determine by experiment whether all rays of light are transmitted at the same velocity. Common subjects include turbines; physics; Henri Giffard's invention of the injector; an apparatus for atmospheric electrical experiments; expanding gas; and the purchase of chemical substances.

There are many letters to the Bailliere Brothers, importers of periodicals; and E. G. Wallis, the Assistant Assessor of the third district of Boston for taxes. In 1862, Boyden wrote a letter to Massachusetts Governor John A. Andrew offering a letter of recommendation for hydraulic engineer James B. Francis. Boyden also paid for a lecture in 1862 given by George Boutwell on liberating some Southern slaves. Letters from the 1870s discuss a variety of topics, including patents, the New England Glass Company, and the purchase of books. Finally, a folder of miscellaneous materials includes several letters of recommendation and introduction for Boyden, and a few letters neither to nor from Boyden.

Series 2, Notes on Turbines, 1833-1870, contains primarily Boyden's notes and calculations relating to the design, development, construction, and testing of turbines. There are also drawings of turbines, excerpts from scholarly journals about turbines, and the manuscript article about turbines for *American Cabinet* authored by Boyden. A published copy of this article is located in Series 10, Printed Material, 1835-1879. Some materials are in French.

A large portion of the papers are the calculations and results of experiments on Turbine No. 3 of the Atlantic Cotton Mills. More information on these experiments can be found in the Series 5, Notebooks, 1819-1867, and Series 6, Lawsuits, 1836-1864. Experiments conducted at the Appleton Company, where Boyden developed the Boyden turbine, appear in this series.

The turbine notes also contain measurements and computations for turbines for the Chicopee Manufacturing Company; designs and calculations for the Tileston and Hollingsworth's turbine in Dorchester, Massachusetts; an estimate for installing turbines for the Jackson Company; and a report to the Boston Water Power Company on the estimate of power from the Boston and Roxbury Mill Dam. Boyden was assisted in his calculations and experiments by Maximilian L. G. Wilde, Edward Sawyer, [Neil?], W. Mertz, David Dows, and James Emerson. The series contains an oversize miscellaneous folder comprised of calculations and tables.

Series 3, Subject Files, circa 1827-1875, contains groups of papers that Boyden assembled into packets and numbered and labeled with topical categories. The papers cover a wide range of topics. A large portion of the materials are excerpts or notes from published sources, although some packets contain Boyden's own calculations, tables, and surveys. Some materials are in French, German, and Greek and some have been translated from French and German into English.

One subject Boyden explores in depth is tobacco, including the tobacco trade, taxes on tobacco, consumption statistics from the United States and Europe, different varieties of plants, and tobacco's effect on health, including whether or not it contributes to mental illness. In addition, he discusses alcohol's effect on health; whether crime is connected with drinking alcohol, liquor licensing laws, and the option of prohibition in Massachusetts. He was also interested in the early history of the Bible, including how it was translated from the original Hebrew and how Egyptian connects to Old Testament history. Boyden compares different religious practices, including Islam, Buddhism, Taoism, Confucianism, and ancient Greek and Egyptian religion.

Boyden collected a great deal of information from census data in the United States and Great Britain. In the Boston area, he looks at the number of births among Irish immigrants compared to native born Americans, and in particular explores whether tobacco use increases or decreases births among Irish immigrants. He also utilizes population statistics to discuss mental illness in both Europe and the United States. Like Series 4, Notes and Papers, 1806-1879, the Subject Files contain statistics on the cause of and response to fires in Boston.

Finally, the Subject Files include information on a variety of scientific subjects. For instance, a portion of materials discuss hydraulic lime, atomic theory and molecules, chemistry, thermoelectricity, meteorology, astronomy, batteries, and water pressure through pipes. Boyden quotes from Charles Darwin's *On the Origin of Species* in his explorations of natural history. Several packets are comprised of surveys of property lots in Brookline, Massachusetts and the Longwood area of Boston. Sources Boyden utilized include publications such as the *Encyclopaedia Britannica*, the *Bible*, the *New York Herald*, *The Boston Daily Advertiser*, *L'Annales des Ponts et Chaussées (The Annals of the Department of Civil Engineering)*, *Brockhaus's Encyclopaedia*, *Annals of Chemistry and Pharmacy*, *Les Comptes Rendus de l'Académie des Sciences (The Proceedings of the French Academy of Sciences)*, *Annales de Chimie et de Physique (Annals of Chemistry and Physics)*, *Annales d'Hygiène (Annals of Hygiene)*, *Appleton's Cyclopaedia*, *Hunt's Merchant's Magazine*, *Esquirol's Treatise on Mental Maladies*, *The London Times*, and *Poggendorff's Annals*. The packets also contain call slips from the Boston Athenaeum and the Boston Public Library.

Series 4, Notes and Papers, 1806-1879, consists of a wide range of material. Some papers are in French and German, or translated from published French and German into English. The series encompasses notes from Boyden's scientific experiments and observations. One subject Boyden studied in depth was meteorology, and the series contains weather observations, recordings of temperature and air pressure, and eyewitness accounts of unusual weather.

In addition, Boyden conducted experiments on the effect of a dam in the Merrimack River, the specific heat of steam, electricity, the effects of rays on bisulphide of carbon, glass making, and oils. Five notebooks document experiments on the chemical combination of oxygen with liquids at atmospheric temperatures. Furthermore, the series contains information on sound experiments made at Chelsea, Massachusetts, and at the Charlestown, Massachusetts aqueduct, which are also discussed in Series 5, Notebooks, 1819-1867, and Series 9, Drawings, circa 1835-1872. Boyden conducted surveys of various industrial projects, including the Jackson Manufacturing Company's mill work and dam; the sewers of Lowell, Massachusetts; the Nashua Mills; the aqueduct, cistern and pumping apparatus for the Boston Iron Company; the Lewiston Water Power Company; the bursting of a locomotive for the Boston and Lowell Railroad; and the cold well at Brandon, Vermont.

The series consists of several folders of drawings, including sketches of an apparatus for making signal sounds, and a design for a mercurial pump, and various scientific instruments. There are also copies of drawings of a differential galvanometer, dynamometer, pneumatic apparatus, and pneumatic glasses. The originals are located in Series 9, Drawings, circa 1835-1872. A significant portion of the series consists of Boyden's investigations of the causes of fires in Boston, including statistics and eyewitness accounts. The series also contains Boyden's computations and design for a chronometer.

Boyden is the author of several published papers found in this series, including "*Researches in Meteorology*," "*Paper on Mechanical force*," "*An Essay on Caloric's Repulsing Caloric and its Attracting Ponderable Matter*," and "*Paper on Sound*." "*Explosions produced by Niter in Burning Buildings*" appeared in *The Boston Post* May 9, 1862. Boyden also wrote *Researches in Physics*, which was printed in 1863. The series also contains translations and copies of papers and articles on various scientific subjects, including magnetism, electricity, heat, light, meteorology, and physics. These include articles from the *Annales de Chimie et de Physique (Annals of Chemistry and Physics)*, the *Bulletin des Sciences Mathématiques (Bulletin of the Mathematical Sciences)*, the *Annalen der Physik und Chemie (Annals of Physics and Chemistry)*, *Mémoires de l'Académie Royale (Imperial) des Sciences de l'Institut de France*, and *Les Comptes Rendus de l'Académie des Sciences (The Proceedings of the French Academy of*

Sciences). Boyden also collected single works, including *A Treatise on the Heat of Permanent Gases by John Plana*, *New Branch of Physics, or Studies Concerning Bodies in the Spheroidal State* by P. H. Boutigny, and *Thermochrosis, or Calorific Coloration* by Macedoine Melloni.

Nine miscellaneous folders contain citations from encyclopedias, notes from scientific articles and newspapers, calculations, notes on laws, notes from experiments, a tide table, accounts of the weather, directions for experiments, specifications for a section of a canal built in Lowell by the Proprietors of the Locks and Canals, and a description of a heliostat. One oversize miscellaneous folder contains a legal document concerning lease from the Boston and Roxbury Mill Corporation to Horace Gray, a plan of a screwdriver, a table of experiments made in grinding rye at the City Mills, and experiments on the flow of water over dams made at the Lower Locks in Lowell, Massachusetts.

Series 5, Notebooks, 1819-1867, consists of bound notebooks ranging in size from 5" x 7" to 7" x 8". The notebooks demonstrate Boyden's wide-ranging scientific interests. They contain primarily technical information, such as experiments on sound, electromagnetism, and thermometers and include drawings and tables with data. His notebooks include excerpts from scientific journals on physics and chemistry, including some materials in French.

The personal memoranda feature notes from his travels around New England and the Mid-Atlantic States, including descriptions of railroads, dams, and mills; bridges in Georgetown, Washington, District of Columbia; a smelting furnace in Pottsville, Pennsylvania; and the Baltimore Water Works aqueduct. Several additional personal notebooks document Boyden's property and expenditures. Many notebooks were written or corrected by others, presumably Boyden's assistants, including Edward Sawyer, Levi York, Maximilian S. G. Wilde, Charles Leonard, Charles Mason, Jeremiah Dickson, L.W. Cushing, and A. Neill. One common subject is Boyden's work with turbines and water-wheels at New England mills and manufacturing companies. Many notebooks record turbine experiments at the Lowell Appleton Company, where Boyden developed the Boyden turbine, and at the Atlantic Cotton Mills. For more information on Boyden's work at the Atlantic Cotton Mills, see Series 6, Lawsuits, 1836-1864 and Series 2, Notes on Turbines, 1833-1870.

Other notebooks document Boyden's involvement in the Amoskeag Manufacturing Company in Manchester, New Hampshire, where he developed a hydraulic power system. Other mills Boyden studied include the Stark Mills, the Lawrence Company's mills, and the Boston and Roxbury Mill Dam. Boyden was interested in the construction of canals and locks, including the Weston Canal near Lowell, Massachusetts. Railroad surveys comprise a significant portion of the notebooks' content and include his work with railroad companies, including the Boston and Lowell Railroad Corporation and the Boston and Worcester Railroad Corporation. Boyden conducted a survey of a cold well at Brandon, Vermont. More information about that well can be found in Series 3, Subject Files, circa 1827-1875, and Series 3, Notes and Papers, 1806-1879.

Series 6, Lawsuits, 1836-1864, consists of legal materials related to lawsuits Boyden was involved in, both as a plaintiff and as a witness. The majority of the series is comprised of documents relating to Boyden's Atlantic Cotton Mills lawsuit, a conflict over whether Boyden had a right to conduct tests on turbines built from his design at the Atlantic Cotton Mills. The suit also involved a dispute over Boyden's patent rights to his turbine improvements used at the Atlantic Cotton Mills. On February 14, 1856, the court decided in favor of Boyden, and required the Atlantic Cotton Mills to award him reparations.

The series contains copies of correspondence related to Boyden's dealings with the Atlantic Cotton Mills, including letters to and from Charles S. Storrow and William Gray, treasurers of the Atlantic Cotton Mills. Also included are depositions; replies to allegations; Boyden's drafts of his answers to interrogatories; and calculations, notes, and drawings, presumably used as evidence in court. Bernhard Schultze (see Series 12, Bernhard Schultze Materials, 1837-1857) compared and corrected Boyden's November 21, 1855 reply to the answer of the Atlantic Cotton Mills and a statement of some expenses in measuring the power expended in actuating turbine No. 3 of the Atlantic Cotton Mills.

Also included are letters of reference for Boyden, probably related to his lawsuit of the Nashua and Lowell Railroad; Boyden's answers to interrogatories filed by the Boston Water Power Company in the case of *Boston Water Power Company v. Horace Gray*, which also includes his answers to interrogatories filed by the Boston and Worcester Railroad Company in regard to the receiving basin of the Boston Water Power Company; and Boyden's deposition in the case of *Oswego Canal Company v. Henry M. Ames & Isaac L. Merriam*.

Series 7, Financial Papers, 1820-1876, contains both personal and business financial papers. A large portion documents the New England Glass Company, including records of the stockholders meetings and end of year reports on the financial state of the company. There are also copies of receipts of bills Boyden sent to companies he worked for, including the Atlantic Cotton Mills, the Amoskeag Manufacturing Company, the Boston and Lowell Railroad Corporation, the Ames Manufacturing Company, the Salmon Falls Manufacturing Company, the Lowell Machine Shop, and the Holyoke Water Power Company. Boyden also received stock dividends from some of the same companies and others, including the Merrimack Manufacturing Company, the New England Glass Company, the Old Colony Railroad Company, Stark Manufacturing Company, the Lancaster Mills, the Amoskeag Manufacturing Company, the Boston and Lowell Railroad Corporation, and the Boston Gas Light Company.

Another aspect of the papers includes Boyden's requests to buy certain items, including metals, glass cylinders, and wire for his experiments; books in English, French and German; and periodicals. There are also reports of Boyden's income for the Internal Revenue Service dating from 1864-1871. One document is a quitclaim deed for the Savin Hill property in Dorchester, Massachusetts, which Boyden surveyed. Surveying records can be found in Series 3, Subject Files, circa 1827-1875.

Series 8, Patents, 1838-1847, consists of three subseries, Subseries 1, Boyden's Patents, 1843-1847; Subseries 2, Other Patents, 1838-1843; and Subseries 3, Patent Assignments, 1849-1856.

Subseries 1, Boyden's Patents, 1843-1847, consists of issued patents for Boyden's turbine improvements with attached drawings and specifications, including patents for improvement in turbines, September 20, 1843 (US Patent 10,026); improvement in hydraulic motors, September 20, 1843 (US Patent 10,027); improvements in hanging shafts of waterwheels, April 17, 1847 (US Patent 5,068); and improvement in diffuser for waterwheels, May 1, 1847 (US Patent 5,090).

Subseries 2, Other Patents, 1838-1843, consists of a patent granted to John R. Wheeler for an improved waterwheel on April 14, 1838, and a patent granted to Amasa B. Beckwith for improvement in waterwheels on October 20, 1843.

Subseries 3, Patent Assignments, 1849-1856, consists of legal documents giving various companies the right to use Boyden's patented turbine improvements in their mills in exchange for royalties. Companies include the Great Falls Manufacturing Company, the Amoskeag Manufacturing Company, the Appleton Company, the Amoskeag Manufacturing Company, the Merrimack Manufacturing Company, the Lowell Manufacturing Company, and the Lowell Machine Shop.

Series 9, Drawings, circa 1835-1872, contains oversize drawings and some tables, ranging in size from approximately 48" x 30" to 21" x 30". Some of the papers are brittle and crumble easily. The series contains one work in German, "*Werke Theorie und Bau der Wasserraeder*" (*A Work on the Theory and Construction of Waterwheels*).

A significant portion of the series consists of Boyden's designs for turbines used at various mills throughout New England, including the Ames Manufacturing Company; the Amoskeag Manufacturing Company; the Appleton Company, the Atlantic Cotton Mills; the Hamilton Manufacturing Company; the Essex Company Machine Shop and Blacksmith Shop; the Lancaster Mill; the Manchester Printing Works; the Merrimack Manufacturing Company; the Merrimack Print Works; the Perkins Mills the Salmon Falls Manufacturing Company; the Stark Mills; and the New England Worsted Company and Suncook Manufacturing Company. More information on Boyden's work designing turbines for these companies can

be found in Series 1, Correspondence, 1823-1879; Series 2, Notes on Turbines, 1833-1870; and Series 5, Notebooks, 1819-1867.

Of particular note are drawings from "Lowell Hydraulic Experiments", a work published in 1855 by James B. Francis. Francis developed an improved turbine based on the inward flow Poncelet turbine, which became known as the Francis turbine and was more efficient than the outward flow Boyden turbine. Boyden was an associate of Francis's, but it is unclear how closely involved he was in the development of the Francis turbine. One subseries, Boyden's improvements, contains drawings that demonstrate Boyden's development of new turbines.

The series also includes records from Boyden's experiments on sound in Charlestown, Massachusetts. Notes from other experiments on sound can be found in Series 4, Notes and Papers, 1806-1879, and Series 5, Notebooks, 1819-1867. Included in the series are designs for various tools, including a chronometer, differential galvanometer, hydraulic apparatus, and pneumatic glasses. Smaller copies of some of these drawings can be found in Series 4, Notes and Papers, 1806-1879.

Two folders of miscellaneous materials include several tables documenting people admitted to mental hospitals, the observation of tides made at the Charlestown Navy Yard; a table of fires in Boston; experiments on the wheel of the Poncelet System; a plan and sections for showing the results of surveys at the cold well in Brandon, Vermont; and designs for a brass apparatus, a rack of reflectors, an apparatus for measuring the heights of water, a glass scale, and a dynamometer. Nine folders contain unidentified drawings.

Series 10, Printed Material, 1835-1879, contains newspaper clippings and other printed material collected by Boyden. The major subjects covered by the newspaper clippings include a campaign to supply Boston with drinking water, the American Association for the Advancement of Science, and the Smithsonian Institution. Other newspaper clippings discuss the career of Patrick Tracy Jackson, the founder of the Merrimack Manufacturing Company; Boyden's turbine wheel; railway accidents; a court case involving an escaped slave; the rotation of the earth; the establishment of a public library in Boston; the American Academy of Arts and Sciences; the Louisiana imbroglio of 1874-1875; and smoking. Boyden frequently clipped from the *Daily Evening Traveller*, the *Boston Advertiser*, *The Boston Atlas*, the *Boston Post*, and the *Boston Evening Transcript*. Some newspapers have been saved and placed in a folder in a map case drawer.

The series also includes a pamphlet entitled *Martin's Twenty-One Years in the Boston Stock Market, or Fluctuations Therein* from January 1835 to January 1856, two bulletins of new books offered by the Boston Public Library and marked up by Boyden, patents for Alfred Nobel's new explosive compound, several of Boyden's business cards, a print portrait of Boyden, and a metal sign that hung outside his office in Boston. The series contains one miscellaneous file that includes items such as a price list for mechanists' tools, an article on the phenomena of sound, and a table of the work and expenses on the Boston and Lowell Railroad.

Series 11, Seth Boyden Materials, 1840-1841, is comprised of documents related to the death of Uriah Boyden's father, Seth Boyden (1764-1840). Included are drawings of the headstones for the graves of Seth Boyden (1764-1840) and Uriah Boyden's sister, Sarah Boyden; Seth Boyden's last will and testament; a poster for an executor's sale; and the account of Uriah Boyden and Benjamin F. Boyden, the executors of Seth Boyden's (1764-1840) last will and testament.

Series 12, Bernhard Schultze Materials, 1837-1857, contains the letters and papers of Bernhard Schultze, a man employed by Boyden as a translator from around November 26, 1853 until his death in August 1857. Schultze was a witness in the case of *Boyden v. Atlantic Cotton Mills* and compared and corrected materials related to the case. These can be found in Series 6, Lawsuits, 1836-1864. He died from a head injury that occurred in Boyden's offices at 81 Washington Street.

More information about the accident in Boyden's official statement, August 17, 1857, to the coroner and the jury investigating Schultze's death, in Series 1, Correspondence, 1823-1879. Half of the materials are in German and consist of correspondence, receipts, registered letter slips, a medical bill, and a program for the Paine Festival and Annual Ball in 1857. Several of the documents relate to politics in the late 1850s and the election of 1856. Included is a newspaper article reporting on a pro-German James Buchanan rally; a circular supporting John C. Fremont and William L. Dayton, the Republican ticket in the election of 1856; and the by-laws of the Boston Kansas Club.

Series 13, Joseph Sidney Francis Materials, circa 1855-1872, consists of drawings made by Joseph Sidney Francis while studying at the Massachusetts Institute of Technology. They are labeled as the property of James B. Francis, the hydraulic engineer and inventor of the Francis turbine who worked closely with Boyden. Included in this series are tables documenting the number of fires in Boston and the number of people admitted to French mental hospitals.

Arrangement

The papers are arranged into thirteen series. The contents of each series or subseries is arranged chronologically, with the exception of Series 3, which is arranged numerically, and Series 9, which is arranged alphabetically by subject. The series and subseries arrangement of the papers are as follows:

Series 1, Correspondence, 1823-1879

Subseries 1, Outgoing, 1830-1879

Subseries 2, Incoming, 1823-1879

Subseries 3, Miscellaneous, 1825-1879

Series 2, Notes on Turbines, 1833-1870

Series 3, Subject Files, circa 1827-1875

Series 4, Notes and Papers, 1806-1879

Series 5, Notebooks, 1819-1867

Series 6, Lawsuits, 1836-1864

Series 7, Financial Papers, 1820-1876

Series 8, Patents, 1838-1847

Subseries 1, Boyden Patents, 1843-1847

Subseries 2, Other Patents, 1838-1843

Subseries 3, Patent Assignments, 1849-1856

Series 9, Drawings, circa 1835-1872

Series 10, Printed Material, 1835-1879

Series 11, Seth Boyden (1764-1840) Materials, 1840-1841

Series 12, Bernhard Schultze Materials, 1837-1857

Series 13, Joseph Sidney Francis Materials, circa 1855-1872

Names and Subject Terms

This collection is indexed in the online catalog of the Smithsonian Institution under the following terms:

Subjects:

Atomic theory
Census
Chemistry
Chronometer
Civil engineers
Dividends
Drinking of alcoholic beverages -- Law and legislation
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Amoskeag Manufacturing Company.
Atlantic Cotton Mills.
Boston and Lowell Railroad Corporation.
Boston and Roxbury Mill Corporation.
Boston and Worcester Railroad Corporation.
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Francis, James B. (James Bicheno), 1815-1892
Hamilton Manufacturing Company (Lowell, Mass.).
Jackson Manufacturing Company.
Lawrence Company.
Lowell Appleton Company.
Lowell Manufacturing Company.
Manchester Printing Works.
Merrimack Manufacturing Company.
New England Glass Company.
Nobel, Alfred Bernhard, 1833-1896
Saco Water Power Company.
Salmon Falls Manufacturing Company.
Sawyer, Edward
Smithsonian Institution
Stark Mills
Storrow, Charles S. (Charles Storer), 1809-1904
Straw, Ezekiel Albert, 1819-1882
Suncook Mills Company.
Tilestons & Hollingsworth Upper Mill.

Geographic Names:

Boston (Mass.)
Brandon (Vt.)
Brookline (Mass.)
Charlestown (Boston, Mass.)
Foxborough (Mass. : Town)
Lowell (Mass.)—Industries
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