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Charles Steinmetz Papers Finding Aid

Charles Steinmetz (1865-1923),
Papers
15 cubic feet

Finding Aid created by Chris Hunter, Archivist.

Biographical Information:

Summary of Life:

Charles Steinmetz (1865-1923) was one of the foremost inventors, scientists, engineers, researchers, and mathematicians of the late 19th and early 20th Centuries. His most important work was performed at General Electric (GE) from 1892-1923. At GE his major research strengths included hysterisis, the power lost in an electrical system due to the nature of the conducting material; multi-phase motors; alternating current theory; and transient phenomena, the study of power surges and their effects on transmission systems. The study of electrical transients led Steinmetz to develop his lightning generator, in order to allow system tests in a laboratory setting. Steinmetz, who also conducted important work with arc lamps and railway and fan motors, was one of the engineers who helped transform electrical engineering into a respected profession, and was president of the American Institute of Electrical Engineers in 1901.

Germany:

Steinmetz was born Carl August Rudolph Steinmetz in Breslau, Germany on April 9, 1865. He was the son of Carl Heinrich Steinmetz, a lithographer for a German railroad, and Caroline Neubert Steinmetz. Caroline was the widow of Carl Heinrich's brother August. Caroline and August had two daughters, Marie (born 1853) and Clara (born 1857), before his death in 1864. Caroline died in a cholera epidemic in 1866. Carl Heinrich, by 1874, lived with Bertha Mache, a widow of a government official. Bertha had two children with her husband, Clara and Hedwig, and had a third daughter, Margarethe, with Carl Heinrich. Carl Heinrich died in 1890.

Steinmetz enrolled in the University of Breslau in 1883 and there he took classes in advanced mathematics, physics, and astronomy. In 1887 he began working towards a doctorate, focusing on synthetic geometry. Involvement in socialist activities and impending legal action forced him to flee to Zurich, Switzerland in 1888. At Zurich he decided on the study of engineering and enrolled at the Swiss Federal Polytechnic Institute for one semester. Steinmetz's mathematics background made him ideal to explore and understand the complex analyses involved with the new alternating current power systems.

Immigrates to United States
Steinmetz came to the United States in 1889 by the invitation of his Zurich roommate Oscar Asmussen, and began working for Rudolph Eickemeyer as an assistant draftsman. Eickemeyer's company produced hat-making machinery, and was expanding into the electrical field with dynamos, elevator motors and alternating-current railway motors. By 1890 he had become active in the AIEE, and by the time General Electric purchased Eickemeyer's company in 1892, Steinmetz was already a respected electrical engineer.

Joins GE
Steinmetz joined GE's Calculating Department in Lynn, Massachusetts. The Calculating Department made calculations based on designs created by the Railway and Alternating-Current engineering departments. Steinmetz was transferred to Schenectady with the Calculating Department in December 1893 and was placed in charge of the department in early 1894. Ernst Berg, another member of the department when it moved, became a close friend and roommate of Steinmetz. Berg, who handled Steinmetz's administrative affairs, roomed with Steinmetz at rented homes on Washington Avenue and Liberty Street through 1901. As head of the Calculating Department, Steinmetz unofficially became chief engineer of the company and the Calculating Department grew and became responsible for much of the design work in the company.

As the most important engineer at General Electric, Steinmetz recognized the need for science-based industrial research at General Electric, particularly to maintain its advantage in the incandescent lamp field, which was being threatened by new developments in Europe. He recommended that the GE create a Research Laboratory, which was started in 1900. Steinmetz was named to the Research Lab's advisory council, but the lab itself was directed by Willis R. Whitney, an MIT-educated chemist. By 1900, as motors became more standardized, design work, except for new lines of equipment, left the Calculating Department, and Steinmetz became a consulting engineer to the company. After 1901, when the laboratory on his lot in the GE Realty Plot was completed, Steinmetz did much of his work, which was focused at that time on electrochemistry and transient phenomena, at home. In 1910, based on Steinmetz's recommendation to coordinate engineering design throughout the company and regain the originality in design that Steinmetz believed was lost due to the decentralization of design, GE established a Consulting Engineering Laboratory, with Steinmetz as technical director and C. W. Stone as administrator. Other members of this department included Ernst Alexanderson and John B. Taylor.

In 1919, the Consulting Engineering Laboratory merged with the Standardizing Laboratory to form the General Engineering Laboratory (GEL), which was directed by Lewis T. Robinson, former head of GE's Standardizing Laboratory. Steinmetz took charge of the high-voltage section of the GEL.

Civic and Family Involvement
Steinmetz became interested in activities outside of General Electric. From 1902 to 1914 he chaired the newly created Union College Department of Engineering. In 1911, the election of the Socialist Mayor George Lunn rekindled Steinmetz's interest in Socialism.

Steinmetz was appointed to the board of education in 1912 and elected its president. In 1913, Lunn created the board of parks and city planning, naming Steinmetz to the board, which then elected him chairman. When Lunn was defeated for reelection, Steinmetz was removed from his positions. Lunn was reelected in 1915, and with him Steinmetz as president of the common council. He was re-appointed to the school board, and again elected its president. A break with Lunn over neutrality in World War I led to the end of Steinmetz's political career. Steinmetz's political and business views converged in his corporate socialist view in which large corporations were the most efficient organization and could best serve the public, but first had to maintain its responsibilities toward society and workers.

Steinmetz initially opposed the United States entering World War I against Germany, his homeland. He supported the war once the United States entered, and in 1918, the Consulting Engineering Department did work for the Naval Consulting Department improving trajectories of high-explosive shells. He became involved in Vladimir Lenin's attempt to electrify Soviet Russia, and continued his high-voltage experiments until his death in October 1923, shortly after returning from an extended tour of California. The tour had confirmed Steinmetz's status as one of the most popular men in America but devastated him physically.

Joseph Hayden was transferred from Lynn to Schenectady in 1901 and assigned as an engineering laboratory assistant. He became Steinmetz's administrator, filling the void left by Ernst Berg when he left Liberty Hall. Steinmetz adopted Hayden, and Hayden and his wife moved into Steinmetz's home in the GE Realty Plot when it was completed in 1903. The Hayden family, including wife Corinne Rost, and children Joseph, born 1906, Marjorie (or Midge), born 1909, and William, born 1910, lived with Steinmetz the remainder of his life. The Hayden's were often Steinmetz's subjects for his favorite hobby, personal photography. Steinmetz took up personal photography while in Lynn, and continued the hobby until his death.

Scope and Content:

The materials in the collection focus on Steinmetz's early life in Germany, his technical work at General Electric, and his personal photography. It includes correspondence, research notes, drawings, blueprints, and graphs from Charles Steinmetz's research at Eickemeyer's and General Electric. Typed manuscripts of Steinmetz's books and articles. Steinmetz's research notebooks. Photograph albums with photographs taken by Steinmetz and a small number of Steinmetz glass plate negatives and early family photographs from Germany. Also a large amount of materials from his family and early life in Germany, in German, including family legal documents, student notebooks, and various certificates relating Charles Steinmetz and his half-sister Clara. The collection includes a small box of tools used by Steinmetz. The bulk of the material relates to his research. Personal correspondence and information on his civic duties are less represented here.

Series 1: Photographs

Steinmetz was an early personal photographer, and photography was his favorite hobby. He used dry glass plate negatives through most of his life, and assembled prints made in his personal darkroom into photograph albums. All of the photographs in the albums were made from 4x5" glass plates. He used a 4x5" plate camera until 1897, when he switched to a new camera that used 5x7 plates. He finally switched to film in 1921. Most of the photographs here are in albums. There is also a small number of glass negatives, some photographs of family and friends from Germany, and other photographs, primarily publicity shots taken for General Electric.

Box labeled Box1 – Primarily photograph albums.

1) Photograph album: Most photos not in *Steinmetz in Schenectady*. Liberty St., Washington Ave., Camp Mohawk
2) Photograph Album
3) Album patented 1891. Possible topics include Breslau, Yonkers, and Schenectady.
4) Schenectady scenes. Recreation, including Indian Ladder, Plotterkill, steamboats near Albany, trolley bridge over Hudson, Mohawk River, Moon, Adirondack camping, Cohoes Falls, circus parade
5) Album, Canoeing in Mohawk near railroad bridge, cross country skiing. One photo dated 1897.
6) Photograph album with cover removed. Stockade, Niagara Falls, Workshopwith bulbs and meters (and sign saying "Danger 10,000 volts" on wall"), BBO electric locomotive (first GE locomotive), cross country skiing. One photo dated 1896.
7) Album, canoeing and sailing in Schenectady, bicycling, house near building 55, demolition of Bradt House, hunting trip in Adirondacks.
8) Photograph mounted on cardboard, Vladimir Volionoff Lenin to Steinmetz, Moscow, 7 XII 1922. Thanks Steinmetz for being one of the few scientists not opposed to proletariat.
9) Photograph, 7 young men (college age?), no date or other ID. Some silver oxidation.
10) Photograph, Edison and Steinmetz, 1922
11) Photograph, portrait shot of Steinmetz in Yonkers, 1889 or 1890, standing next to chair.
12) Steinmetz photographs, c. 1905, Steinmetz writing at table, 1917, Steinmetz leaning on chair. Signed photograph of Steinmetz in conservatory.

Small orange box of family photos from Germany, some identified, including:

1. Tintypes of family members, young Steinmetz?
2. Klara Steinmetz, 1893
3. W.S., 1886
4. Hedwig Mache
5. Klara Steinmetz (with fake mustache)
6. Elisabeth Mache
7. Klara Mache
8. Margarete Mache
9. Klara Steinmetz (in oriental dress)
10. Maria and Otto Schimmel

11. Bertha Mache
12. Marie Steinmetz
13. Cart de visite of young Steinmetz in Zouave uniform, Steinmetz with grandmother, etc. C. Schmidt studio, seem to be early family

Steinmetz Glass Plate Negatives

1) #55, 1893 Drafting room
2) #682 Fall 1897, Sander's Lake outlet, culvert arch with locomotive
3) #415 In electric launch to camp
4) No #, Fort Ticonderoga, about 1890, might not be Steinmetz, 4 ¼ x 4 ¼
5) No #, Lighthouse, Hudson River, might not be Steinmetz, 4 ¼ x 4 ¼
6) No #, Lighthouse, Hudson River, might not be Steinmetz, 4 ¼ x 4 ¼
7) #74, On the Kitty West, Schenectady, 1894
8) #427, McKinley in town, 1894
9) #421, Flood 1895, 4-10-95
10) #27, Carriages at Railway Depot, 1893
11) #46, Factory yard mirage, 1894 (be circumspect of 12-21 numbers some came from empty envelopes)
12) #50, Circus Parade, State Street, 5-28-98
13) #140, Circus Parade (Negative is cracking)
14) #54, Scotia bridge with Degraff tavern on Scotia side, May 1897, 9
15) #52, Dollus Park, Rexford, early 1900
16) #49, State Street in Snow, February 7, 1898
17) #29, Flood, October 10, 1903, Schenectady approach to Scotia bridge, from the bridge
18) No#, Damage done by icebreak on Rotterdam St., February 16, 1900
19) #30, Snow covered trees from reading room window, January 10, 1901. From Ellis house looking toward Liberty St. bridge
20) #161, Indian Ladder, 1899
21) #27, Camp Mohawk (Steinmetz), July 1899

Empty envelopes:
1) #135, Circus Parade
2) #337, Steamer excursion, 1902, Crown Point Landing
3) No#, Cohoes Falls
4) #202, Streetcar
5) #224, Ferris Wheel
6) #101, Stone on St. Stor taking pictures, 1898
7) #243, view on deck, Lake Champlain Steamer
8) #78, Aqueduct from top, 1897
9) #162, Launch party, 1899
10) #121, Ferry boat in New York Harbor
11) #344, Steamer excursion, 1902, Port Henry Landing
12) #318, Plantation, June 8, 1902, view of canal, towpath, and river
13) #80, view below aqueduct, 1897

14) #216, Interior of powerhouse, Mechanicville
15) #169, Camp Mohawk, July 1899
16) #204, Damage done by icebreak on Rotterdam St., February 16, 1900
17) #341, Steamer excursion, 1902, "Shifty" going to hunt at Crown Point
18) #99, State Street, February 7, 1898

Series 2: Germany

Split primarily between legal documents from his family and student notebooks from the University of Breslau. Includes certificates of Steinmetz and his sister Clara and some child drawings and crafts attributed to Steinmetz. Many of the legal documents are related to the death of his uncle August in 1864 and mother Caroline in 1866. Other legal documents date from the 1870s and the 1890 death of his father Carl Heinrich. School documents include student notebooks, completion certificates, and a list of classes taken by Steinmetz at the University of Breslau. Also includes several sketches and artistic items signed Steinmetz, possibly drawn by his father Carl Heinrich, a lithographer for a German railroad.

Box labeled Box 5: Schenectady Association on Box

1) Book, AMIC 171A: Organ fur die Gesellschaft der Frennde, Breslau. 26 September 1863, 5 March 1864. (German)
2) Reinschriften der Klara Steinmetz. (German)
3) Reinschriften der Klara Steinmetz. (German)
4) Otto Spamer's *Illustricter Almanach*, 1874, Leipzig (German)
5) House keeping ledger, 1866-1870, C. Steinmetz, (German)
6) Folder, "Humorous sketch of Charles Steinmetz," Breslau,1 August 1885 (German, also includes English translation). Also includes drawing of AC electric motor, 12 August 1889, stamped Ch. St. Card glued to drawing, Oscar Asmussen, Mech. Engineer.
7) Folder, family materials, 1857-1878. Includes death certificate of Carl August Steinmetz, Vaccination certificate of Carl Steinmetz. (German)
8) Folder, Steinmetz family materials, 1857-1878. Includes Carl's vaccination certificate, 1866, Clara's baptism certificate, 1857. Many accounts, official documents, *Breslau Morning News* issues of 28 August 1866, 30 August 1866, 8 January 1864. (German)
9) Folder, Steinmetz family legal documents, 1857-1877. Many dated 1864, and are probably associated with death of uncle Carl August Steinmetz and mother Caroline Steinmetz. Also includes undated 18 page booklet of song lyrics or poetry, with index card attached saying "Early Life." (German)
10) Folder, 19th century bookplates, partially colored sketch of a town, signed K Steinmetz, 1850.
11) Folder, Charles Steinmetz, childhood items. Includes certificate of promotion from Royal Testing Commission, 29 September 1883, Breslau. 1870 letter with child's drawing of train on back. Child's crafts, 1870. Invitations, 1873-6. Also legal documents, 1876-1878.
12) Book with loose correspondence, labeled Carl Steinmetz, stud. Math. Includes 1847 legal paper and papers relating to Carl August, 1864.

13) Folder, Miscellaneous documents and personal items. Steinmetz certificates, dated 1885 and 1888. 1839 Christmas card from August Steinmetz. Colored sketch by Karl Steinmetz, no date. Child's crafts. Drawings signed Steinmetz. Strand of Marie Steinmetz's hair, 1864. 1889 certificate, Zurich, 1889, Eidgenossiches Polytechnikum. Technical drawing of a chalice, signed Steinmetz. Drawing of streetcar motor no. 3, 1889.

Box 3:

14) Student Notebooks of Karl Steinmetz at University of Breslau (German):
    a) 1883
    b) No date, *Magnetisms*
    c) 1884, *Function and Theory Dr. Staude*
    d) 1888, *Elechtrochemistry*
15) Loose student notebooks and class books of Steinmetz, (approximately 100). (Most in German). Student and later. One notebook includes and a list (English) of books lent. 1 includes loose drawings and sketches

Series 3: Articles, Books, and Lectures

Arranged alphabetically. Includes manuscripts and typescripts of books, articles, lectures. Most are typewritten and include handwritten corrections. Copies of several articles in Steinmetz's own shorthand system are included with the typed versions. A variety of topics from Steinmetz's varied interests, including science, mathematics, engineering, corporate welfare, education, socialism, government, and World War I.

1) "53-60 other set." Includes note thanking Hayden for his comments on "Creighton's" paper and a portion of a paper on radiation.
2) *America and the New Epoch*, typescript with minor grammatical revisions.
3) Lectures on illumination: IX "Light and Radiation" (portion), X "Light flux and distribution," XI "Light intensity," XII "Illumination and illuminating engineering," XIII "Physiological problem of illuminating engineering" (portion).
4) *Alternating Current Phenomena*, Chapter IX, "Constant Potential-Constant Current Transformation," handwritten manuscript
5) *Theory and Calculation of Alternating Current Phenomena*, List of illustrations for the fourth edition
6) From *Theory and Calculation of Alternating Current Phenomena*:
    a) Chapter XXVI, "Rectification."
    b) Note, Chapter IX and Chapter XXV, Moved to separate folder
    c) Original diagrams
    d) Chapter IX, Record sheet
    e) Chapter X, (original Chapter IX, renumbered)
    f) Chapter XXXIX "Balanced Polyphase System"
    g) Chapter, "Synchronous Induction Generator"
    h) Chapter XII, "Phase Control"
    i) Page 77 insert
    j) "Armature Reactions of Alternators"
7) *Transient Phenomenon*, Record sheets and diagrams, Chapters I-IX

8) *General Lectures on Electrical Engineering*, Lectures I-XIV
9) *Engineering Mathematics*
10) *Engineering Mathematics,* second edition, signed Ch.P.St., completed December 23, 1914.
11) "Four Lectures on Relativity and Space"
12) *Electric Traction and Transmission,* Chapter IV, "Motor Characteristics."
13) *The Constants of the Electric Circuit*, Section I: Duplicates and Records. Handwritten tables: Temperature determinations by entectic alloy, 1 October 1917.
14) "Abnormal Strains in Transformers," by Steinmetz.
15) "Address of the Physiological Effect of Radiation," paper presented by Steinmetz at the Illuminating Engineering Society, New York, 27-29 September 1909.
16) Graphs and tables related to Adiabelic Curves
17) "Autotransformers versus Transformers for High Voltage Tie Cables," November 1920, Charles P. Steinmetz
18) Handwritten calculation, Bayne's Motor, March 1920
19) "Coal and Water Power," 14 February 1922
20) "Characteristics of Electrical Energy and Affecting Chemical Industries,: American Electrochemical Society, 1914
21) "College Fraternities," June 1914
22) "Competition and Cooperation," September 1913, January 1914, Four versions
23) "Cooperation," for International News Service, 16 January 1917
24) "Development of Schenectady's Education System," 1916, includes shorthand handwritten draft.
25) "Insulation: The Dielectric Breakdown of Air as a Conductivity Phenomenon," July 1922.
26) "Dielectric Fields," May 1923
27) "Disruptive Strength of Air," handwritten tables, calculations, dates include 9 February 1910 of page of calculations, 22 June 1922 on blueprint of graph.
28) "Double Periodic Vectors," 29 December 1900, sketches and calculations
29) "Dr. Steinmetz's Own Estimate of His Work," *GE Review* article, negative photostat
30) "Einstein's Theory of Relativity," 8 July 1921, typed manuscript
31) "The Electrical Power Industry Part II: The Relation of the Electric Power Industry to the Industrial Corporation," December 1922, *GE Review* reprint
32) "The New Electrical Course," *The Concordiensis*, Union College, 18 February 1902, Volume XXVI, Number 17, negative photostat
33) "Electric Disturbances and the Nature of Electrical Energy," typed manuscript with handwritten corrections, undated
34) "Electricity in Home and Industry," handwritten in shorthand, subheadings in longhand
35) "Engineering Problems of the Electric Power Industry," April 1923, typed manuscript
36) "England's Interference with Neutral Trade," National Education Service, 4 pages, 29 June 1915
37) "Entropy and Temperature," 2 pages, handwritten notes and calculations
38) "From Competition to Cooperation," 19 July 1921, typed manuscript

39) "The Importance of National Unity," Opening Address of the Organization Conference of the American League for National Unity, Washington, D.C., June 14, 1917, typed copy
40) "Improvement in Efficiency of Electric Power Supply," 16 August 1922, includes 2 blueprint figures, typed copy with handwritten notes
41) "Industrial Cooperation," 11 April 1919, typed manuscript with handwritten notes
42) "Insulation: The Dielectric Breakdown of Air as a Conductivity Phenomenon," July 1922, includes blueprints of two figures
43) "Insulation," informal talk given before the Insulation Section of the GE General Engineering Laboratory on 22 September 1922
44) Introduction to "Pulling Together," by John Broderick, third edition, 1922, about cooperation between labor and management
45) "The Law of Conservation of Energy," 1911, Franklin Institute, typed copy with handwritten correction, includes 2 pages of handwritten figures
46) "Low Metal Alloys," 1915, typewritten copy, includes 2 tables "Fusible Alloys," 8 tables "Cooling Curves of Fusible Alloys," 3 handwritten graphs, 1 page shorthand
47) "The Map of Europe After the War," 6 February 1916, National Editorial, typed copy with handwritten notes
48) "Mechanical Thermodynamics," typed copy
    a) General – "Kinetic Molecular Energy," lecture given before the American Electrochemical Society, 1 May 1908, includes handwritten corrections and six pages of graphs. Typescript dated 6 November 1917
    b) "Thermodynamics of Gases and the Gas Engine Cycle," 8 November 1917, includes four figures
    c) "Thermodynamics of Steam and Comparison of Thermodynamic Prime Movers, A. Steam Equations" 2 copies, copy 2 has handwritten corrections, covers the test from *GE Review*, 1909, page 205 to 207
49) Miscellaneous pieces and shorthand. Also pieces not clearly attributable to Steinmetz. Includes short typewritten manuscripts with handwritten corrections:
    a) "The Two Great Achievements of the Russian Revolution are…"
    b) "Induction Motors Where Load and Voltage are Varied," Table
    c) Pages 7 and 8 of paper on invention
    d) Answers to unstated questions about voting rights, women's suffrage, labor issues, 11 pages, January 1914
    e) "Electrical Engineering Mathematics, Earliest Records," signed C.P.St., 1905, title page only.
    f) Shorthand, 3 pages, on GE lined paper, paper has printing date 10-17-1908
    g) Steinmetz notes on "Transient Phenomena" title page, by Mr. P.T. Clulow
    h) Calculations, 2 pages
    i) 2 Signed drawings, dated 28 May 1902
    j) 2 unsigned sketches on GE sketch paper
    k) Signed material and equipment request by Steinmetz for T. Dempster, 31 January 1902
50) "Meridian Curves of Rotational Surfaces Representing A Two-Dimensional Gravitational Field by a Curvature of Space Proportional to the Distance from the Center, Inside of the Mass, and Inverse Proportional to the Square of the Distance

from the Center, Outside of the Mass," 17 August 1921, illustrated. "Approximate Graphical Construction of Surface of Curvature Representing 2-Dimension Gravitational Field of Circular Mass," 17 p., also 4 p. figures, blue copies

51) "The Monroe Doctrine," 2 copies with handwritten corrections and handwritten shorthand copy
52) Motor articles:
    a) Alternating-Current Motors, handwritten
    b) Synchronous Motors, handwritten
    c) Theory of Propulsion Motor, handwritten
    d) "Notes on the Theory of the Heyland Induction Motor," typed
53) "The Nature of Transients in Electrical Engineering," Paper by Steinmetz submitted to the International Electrical Congress at Turin, typed manuscript with handwritten corrections and 2 pages of shorthand notes.
54) Neutrality Meeting, April 1915, typed copy with handwritten corrections and 1 page of shorthand
55) German and Swiss Newspapers, Breslau, Zurich, Sontag, articles bon (by) Karl Steinmetz, 1888, 1890
56) "Our Industrial System," October 1914, typed copy. "Socialism and the War," October 1914, typed copy with handwritten corrections.
57) "Our Defenceless Panama Canal," for National Editorial Service, June 1915, typed copy with 1 handwritten correction.
58) "Paracetylene," reports, 16 January 1918, 3 March 1918, 7 March 1918
59) "The Periodic System of the Elements," 1917, includes three tables, nine figures. Two figures are GE photographs 109411, 109412
60) "Soviet Russia," Preface
61) Ernst Berg Paper, "Parallel Running of Alternators," presented at the 157th Meeting of the American Institute of Electrical Engineers, New York, 25 October 1901. President Steinmetz in the Chair
62) "Prime Movers," A paper presented at the 234th Meeting of the American Institute of Electrical Engineers, New York, 19 February 1909. Includes final copy and typed manuscript with handwritten corrections
63) "Radiation, Light, Illumination, and Illuminating Engineering III and IV," typed GE Technical Report with two pages of shorthand. On GE lined paper, printing production ate 17 October 1908.
64) "The Science and Art of Illuminating," Lecture before the Philadelphia Section of the Illuminating Engineering Society, December 1915. Typed with handwritten corrections, and response by Preston S. Millar.
65) "The Scope of Illuminating Engineering," February 1916, typed copy with handwritten corrections and two pages of shorthand
66) "The Second Law of Thermodynamics and the 'Death' of Energy, with Notes on the Thermodynamics of the Atmosphere," 1912, GE Review article
67) "System of Electric Transmission and Distribution," a paper read before the GE Engineering Society, 13 November 1900
68) "Theoretical Investigation of Some Oscillations of Extremely High Potential in Alternating High Potential Transmissions," a paper presented at the 18th Annual

Convention of the American Institute of Electrical Engineers, Buffalo, 22 August 1901
69) "The Place of Religion in Modern Scientific Civilization," December 1922, issued as Bulletin No. 13 by the Unitarian Laymen's League, Boston
70) "Theorie der Dampfmaschinen (Theory of Steam Engines), German, no date
71) "Thermodynamic Engineering Equations," December 1918, 9 pages of shorthand and handwritten calculations
72) "Thermodynamic Engineering Equations," December 1918, 14 pages of shorthand and handwritten calculations, and 3 pages of figures
73) "Training Executives," Undated, typed
74) "Transformer Investigations," September 1912, typed with figures, sketches, and graphs
75) "Transient of Simple Circuit Containing A Resistance Varying with the Current (Condenser Discharge Through a Gas Circuit)," December 1921, typescript
76) "The Value of the Classics in Modern Education," August 1913, typescript with handwritten corrections
77) "War or Arbitration," June 1915, for National Editorial Service, typescript with handwritten corrections and two pages of shorthand. Also includes copy of 1856 certificate in German.
78) "The Wealth of America," January 1916, typescript
79) Typed answers to ten questions submitted by *New York Press* in 1915 regarding views on war, politics, and the sinking of the Lusitania
80) Manuscript in German on Hysterisis and Magnetic Resistance (Legal Size)
81) Folder, *Science: A Weekly Newspaper of all the Arts and Sciences*, published by N.D.C. Hodges, 874 Broadway, NY Vol. XX, No. 509, (2 copies). Includes Steinmetz article, "The Energy-function of the Magnetic Circuit." 1892. (Legal Size)
82) Copy of booklet, *Steinmetz, Latter-day Vulcan*.
83) Magazine, *Patents: The Magazine of Invention*, October 1924 issue.

Series 4: Research Notebooks and Notes

Arranged chronologically. Consists primarily of bound notebooks relating to research being undertaken by Steinemtz. Motor development, alternating-current theory, hysterisis, transient phenomena, and arc lamp research are all represented here, along with the notebook from Steinmetz'' poker game, the "Society for the Adjustment of Differences in Salaries." The notebooks are generally in English, with occasional notes made in shorthand. The folders also include loose materials, including graphs, some correspondence, articles, lectures, and tables of data.

Marked Box 5: Includes notes and notebooks, arranged by year.
1) No date. Student notebook, graphs and charts of lamp, generator and dynamo tests, blue ink sketch of a river scene, motor test calculations. Appears to be mostly pre-GE
2) No date. GE drafting sketch book, mostly blank. 2 graphs, 1 dated 1 April 1909 and a sketch of a Brawn Tube
3) 1889. Sketch and explanation of alternating current motor. Notebook, stamped "Chas. Steinmetz, mech. and electr. engineer July 11, 1889." Includes sketches of De La Vergne Refrigerating Machine and some loose pages. Some notes are in

shorthand. Includes notes on a motor for alternating, intermitting or continuous current and carbon brushes. Ends December 20, 1889

4) 1890. Test data for Thomson-Houston arc-light motor and Sprague standard motor
5) 1890-1891. Notebook, "Notes and Sundries – Chas. Steinmetz Electr. Engineer." Begins 12 November 1890 with alternating current generator notes. Includes tests of magnetic permeability of cast steel, interchangeable Westinghouse transformer, and self-regulating arc-light dynamo. Ends in 1892 with test on Lynn whirligig motor
6) 1890-1891. Work papers found in back of 1889 notebook. Includes papers on production of rotating magnetic poles and "Electro dynamic motor for alternating, intermittent and continuous currents." Also includes notes for a patent application relating to alternating current circuits, 11 July 1891, graphs, calculations, shorthand notes, and index to 1889 notebook. Graphs include "Work consumed by Hysterisis (Ewing) in absolute units per cycle," 16 November 1890.
7) Notebook (no folder), 1891-1892, 1900, 1911. Volume was closed on 3 September 1892 and reopened on 20 January 1900 and 1 January 1911. Notes, calculations and sketches on alternating current motors and improvements in elevator motors. 1900 entries include an inventory of chemicals. 1911 notes relate to nitrate production tests.
8) 1892. Bent folder. Graphs and calculations relating to hysterisis tests. Graphs of tests on disruptive discharges through air and mica, calculations of the magnetic reluctance and airspace between two eccentric circles, magnetic characteristics of railway motors, and a table of symbol explanations.
9) 1893-1895.
    a) Loose papers, including notes on the Hartford, CT alternating current power system, curve sheets on three-phase, continuous converters, GE dynamo specification chart, and an 1895 report from Eskil Berg, "Transformer Tests and Calculations."
    b) Notebook, Steinmetz articles, 1915-1922, typescript and shorthand versions, "Sinking of the Lusitania," May 1915; "The Submarine," May 1915; "What is Socialism," July 1921; "Coal and Water Power," October 1922; "Science and Religion," November 1921; "Socialism and Invention," 1919; and "Short Writing," April 1917.
    c) Notebook, April 1893-January 1894. Includes notes on machine installed in Providence, single phase motor theory, compensator synchronizer, and reducing 125 Ampere machines to 62.5 cycles
10) 1895. Electric canoe motors, notes, calculations, graphs
11) 1896. Shorthand notes
12) 1900. Notebook, "Proceedings of the Society for the Adjustment of Differences in Salaries," 1894-1903. Loose pages in back of notebook. Steinmetz's poker club.
13) 1900-1911. Resistances. Tests on pyroelectric sticks, starting shunt motors by means of stick of magnetite, effects of temperature on the resistance of calorized iron wire (1909). Graphs and tables. Also information on tests relating to copper resistance and production of carborundum resistances
14) 1902-1904. Shorthand notes on the flow of an incompressible liquid between coaseial cylindrical surfaces

15) 1903. Tests of Pyroelectrolytes and pulverized magnetite regarding automatic motor starting resistance by E.B. Schattner.
16) 1904. Camp records, "Records of some experiments made at camp." Magnetite resistance and pyrol electrolyte tests, charts and graphs. Tests results by C.M. Green of Research Laboratory on magnetite sticks for mercury arc lamps. 1904 Technical Report, "Magnetite-Mica Short Circuitry Device Description of operation," by E.B. Schattner.
17) 1905. Graph, magnetite resistance
18) 1906. Steinmetz notes on magnetite resistance investigations, including tables, graphs of test results.
19) 1907. Notes of magnetite progress, including graph.
20) 1909. Proposal for a Consulting Department and types of work they could do, report with title page missing related to resistance, insulation, and high voltage lightning arresters.
21) 1910-1912. Signed card, 16 March 1909, relating to time lag tests of disruptive discharge. Notebook, "Lite Tests – Corona on Armature Coils," 1912. Includes tables and some internal GE correspondence to Steinmetz
22) 1912, Letter, Steinmetz to Edwin W. Rice, regarding Steinmetz's views concerning GE organizational structure and lack of coordination within. List made by Steinmetz of things to do, tests on titanium and carbind, single sheet for game record, quota, along with child's doodles. Notebook, lamp tests. Tests start of page 16. Flamer tests begin on page 50.
23) 1913. E.E.F. Creighton report, "The Multi-Recorder."
24) 1914. "Relation of the Consulting Engineering Department to the Organization of the GE Co." Paper had been ripped in half and taped back together, 14 pages.
    a) Report on recording devices, Engineering Council meeting, relates to meters, 11 pages.
    b) Constant potential series lighting by Azomazda lamps, 11 pages.
    c) Testimony given at New York City Hall, 1 June 1914, regarding vocational training in schools and other ideas to improve education system and limit child labor, 30 pages.
    d) Notes on welfare work, March 1914, 12 pages with handwritten notes, on pensions, profit sharing, educational work.
25) 1916.
    a) Letter, G.B. Shanklin, Consulting Department to J.L.R. Hayden regarding dielectric losses in cables. Includes Steinmetz shorthand notes on letter and typed translation
    b) Report, "Recent Developments in Protective Devices," insulators and arresters, 10 pages.
    c) Report, "Fuses," 7 pages, about fuse design problems
    d) "Calculations of Quick Blowing 500 Ampere Fuse," N.A. Lougee. Attached is "Action of Fuses under Transient Overloads." Includes response written by Hayden and shorthand notes
    e) Steinmetz letter to Manager of Switchboard Department, regarding answers to questions about oil switch problems and rupturing capacity, 16 pages.

26) 1917. Letter, F.W. Peek to Hayden regarding corona rectifier. Report analyzing nitrates, phosphates, and potash as agricultural fertilizers, 9 pages. Letter regarding fuse designs, Lougee written at top. Recommendations by Steinmetz to investigate electro-chemical action of high frequency corona, 1918, 3 pages.
27) 1918. Work with Naval Consulting Board. Reports and correspondence regarding ballistics, shell trajectories, and high explosive shells. Shell detonation was considered one of the biggest problems of World War I. Correspondents include Willis R. Whitney.
28) 1918. Work with Naval Consulting Board. Reports on the use of tungsten to strengthen gun barrels and shells, tungsten wire, velocity of projectiles and air friction. Internal letter, Lt. Alger to Steinmetz, regarding the laws of air resistance.
29) 1921.
    a) Folder, "Disruptive strength of air versus oil with permanent versus transient voltages
    b) Folder, handwritten calculations, tables, graphs, some shorthand writing. September 1921
    c) Paper, "Lightning protection of distribution transformers, that is, transformers distributed over the 2300 volt primary distribution lines," Steinmetz April 4, 1921
    d) Calculations of lightning arresters, March 19, 1921
30) 1922.
    a) Breakdown across small and very small gaps, 1 cm molybdenum spheres, direct current and alternating current curves, with tables of experiment data and graphs, July 22
    b) Breakdown across small and very small gaps, 6.25 sphere and plane molybdenum electrodes, direct current and alternating current curves, August 1922
    c) Nernst glower as oscillator – calculations
    d) AC and DC Breakdown, 6.25 molybdenum sphere, small gaps and very small gaps
    e) Frequency transformation by third class conductor, with calculations, tables, graphs, and shorthand, March 23, 1922
    f) DC and AC tests, 6.25 cm and 2.1 cm sphere, August 30, 1922
    g) Dielectric strength of air theoretical, shorthand, calculations, and tables, September 16, 1922
    h) Theory of dielectric strength of air as ionic conduction, calculations and shorthand, September 2, 1922
31) 1923.
    a) Overdamped condenser oscillations, calculations, tables, graphs, May 1923
    b) Condenser discharge through inductive circuit, 2 pages of calculations, May 1923
    c) Oscillations in instantaneous sphere gaps, 3 pages of calculations, May 1923
    d) Conversion of direct into alternating current by third class conductor, shorthand, calculations, June 1923
    e) Nernst glower as oscillator on direct current, calculations, June 1923
    f) Time lag, tables, graphs, 1923
    g) Not Steinmetz: 2 graphs by Edith Clarke, relations at given voltages; 1 graph, phase characteristic of a type of synchronous condenser, ESH 1-12-23

Series 5: Letterbooks: The letterbooks are bound and contain both personal and business correspondence. Some of the business correspondence was indexed in the 1980s. The books are roughly arranged by date.

1. February 1907 and October 1908
2. November 1908 – June 1909
3. July 1909 – September 1910
4. September 1910 – November 1910
5. December 1910 – January 1911
6. February – March 1911
7. March – May 1911
8. December 1911 – June 1912
9. January – December 1912
10. January 1913 – March 1914
11. March 1914 – March 1915
12. March 1915 – March 1916
13. April – December 1916
14. July – December 1912
15. January – June 1913
16. July – November 1913
17. December 1913 - May 1914
18. June – November 1914
19. November 1914 – December 1915
20. June – October 1914
21. November 1914 – March 1915
22. April – August 1915
23. September 1915 – February 1916
24. March – July 1916

Series 6: Certificates, Awards, and Patents

Steinmetz received over 200 patents during his lifetime. Copies of the patents were compiled into a binder. He received honors from several colleges, including Harvard, Union College,and the University of Pennsylvania, and awards from a variety of organizations. Also included are memberships to professional organizations and his citizenship certificate issued in 1896 in Schenectady County Court.

Bound Book: Steinmetz Patents (copies)

Oversized flat items:

1. Honorary Doctorate in Medical Arts, University of Pennsylvania???
2. Membership diploma, American Institute of Electrical Engineers, August 12, 1902
3. Honorary master's degree, Harvard, in the 126th year of the American Republic

Loose items:

1. Oversized photograph, Steinmetz with Einstein
2. Oversized pencil drawing of canoes on pond, willow trees, house in background

3. Purple velvet folder, gold inlay of lightning bolts surrounding transmission tower, with award from Stockholm, Sweden, 1914, medal to Professor Doctor Steinmetz

Currently in box labeled "Box 3" – waiting for rehousing:

1) Folder, Steinmetz shorthand guide, samples of translations, clipping from 1918 *Knickerbocker News*, showing translation chart.
2) Folder, List of patents, books and articles by Steinmetz
3) Folder, miscellaneous correspondence, 1893-1923 (titled 1893-1908). German postcard from Julius Haacke to Steinmetz. 1893 letter, Steinmetz to Werther Herr Uppenburn on stationary, Revere House, Lynn, MA. Photograph of Steinmetz letter, photo number 473868. Correspondence relating to publishing of books. Letter from Henry Darling, Schenectady Realty Co., regarding addition to Steinmetz's property. Steinmetz letter, 1916, concerning his view of World War I. Letter, George Lunn to Joseph Hayden, 1918, acknowledging receipt of letter from Steinmetz. Correspondence with Willis Whitney, Edwin Rice, and the War Department regarding metals used in bullets and projectiles. Also includes 1923 correspondence relating to Steinmetz's West coast trip and his conversation with William Jennings Bryan. Also a letter from Upton Sinclair regarding an "If I Were President" symposium.
4) Folder, Breslau certificates. List of Steinmetz's classes, 1883-1886, 1883-1887. Course completion certificates. Probate estate papers of Carl Heinrich Steinmetz, Steinmetz's father, 1890. 2 additional student notebooks. Announcement of Joseph Hayden's birth, 1906, and letter to Joseph Hayden, Jr., August 1906.
5) Folder, Certificates, Steinmetz and Hayden. Birth announcements for Joseph and Marjorie Hayden. Steinmetz membership certificates to National Marine League, National Conservation Association. Copy of bill authorizing Steinmetz's home as a historic site. Citizenship papers, 1896, in Schenectady County Court. Stock Certificate for Association Island Corp., 1913. Copy of his American Institute of Electrical Engineers membership certificate. Joseph Hayden's employment contract, 1905, 1907, 1910. Joseph Hayden's graduation program, Elmer Avenue School, 1920. War Savings Army Certificate for Marjorie Hayden, appointing her "Corporal." Joseph Hayden's certificate of promotion to high school, 1920. Informational brochure, New York Academy of Sciences, 1891-92. Certificate naming Steinmetz a fellow in the American Academy of Arts and Sciences, 1911.
6) Membership notice in New York Academy of Sciences, 2 November 1891.
7) AIEE, Schenectady Section, testimonial and letter regarding first Steinmetz Memorial Lecture, 1925.
8) Meteorological summary, August 1920.
9) List of magazines Steinmetz received while residing at 53 Washington Avenue.
10) List of books, partially in shorthand.

Series 7: Clippings

Newspaper clippings related to Steinmetz's work, appearances, and civic activities. Many of these clippings were compiled by clippings services and were collected from around the country.

Steinmetz Clippings, 1916 – 1917, clippings appear to be from clippings service

See also two red binders on library shelves, "Steinmetz clippings, arranged by Lois Vermilyea."

Series 8: Blueprints and Sketches
Two brown insulated bags that contain blueprints, sketches, and research data relating to Steinmetz's work at Eickemeyer from 1891-1892, focusing primarily on alternating-current railway motor. The series also contains sketches Steinemtz made in 1895 of a canoe motor.

Large brown bag labeled 1891-1892 papers, Charles Steinmetz

1. Blueprint, Electric Railway Department, with stamp Chas. Steinmetz, Electr. Engineer, graph, train lighting dynamo
2. Four pencil sketches, electric canoe motor, 1895
3. Graph labeled effective amperatures per cm length, maximum magnetization
4. Whole power consumed 37, 420 ampere seconds Car no. 2
5. Toledo compound motor, 40 passengers
6. Thomson-Houston street railway generator and Eickemeyer – Field double motor, Oaksquare to Tremont House
7. Steinmetz electric railroad power station diagrams, September 24, 1892, signed
8. Disruptive strength of dielectrics, November 11, 1892, signed
9. Alternating Current motor regulator, April 13, 1891, signed
10. Alternating Current heterochronous motor, September 10, 1892, signed
11. Torn graph relating to proposal of Schenectady Street Railway Company
12. Explanation of symbols and abbreviations used in work, December 1892
13. Blueprint of graphs and test results of Eickemeyer – Field motor on West End Railway, Boston, 1892
14. Blueprint of graph, self-regulating arc-light dynamo, May 4, 1892
15. Streetcar motor diagram, August 24, 1892
16. Electric canoe motor sketch, March 24, 1895

Unlabeled bag
1. Blueprint, Eickemeyer – Field motor circuit diagram for controlling switch
2. Dynamo specification forms
3. Blueprint, magnetic reluctance of air gaps, 1890
4. Streetcar armature
5. Connecting rods
6. Streetcar motor complete
7. Self-regulating 50 arc light dynamo
8. Notes made on West Lynchburg Railway stationery
9. Table, standard dynamo and motor
10. Sketch, bipolar whirligig fan motor
11. New connecting rod

12. Bipolar slumming bird
13. 9 x 8 pump motor
14. Eickemeyer's direct-coupled 50 HP electric locomotive
15. Connecting rods
16. 10 x 8 electric motor for constant current
17. Streetcar motor field coils
18. Pole-pieces, streetcar, notched armature, additional Boston West End Railway tests
19. Streetcar motors
20. Blueprint, De La Verge ice making plant
21. Westinghouse wire tables
22. 10 x 8 electric motor for constant current
23. Injection cock for liquid ammonia, New York, September 19, 1889
24. Diagram, streetcar motor controlling switch
25. Diagram, connections of Yonkers' streetcar motors
26. Streetcar motor tests, West End Railway, Boston, comparing Eickemeyer Motor with Thomson-Houston
27. Blueprint, explanation of symbols and abbreviations used in work
28. Streetcar motor armature

Series 9: Family and Pamphlet Files:

Folders of items collected at the Historical Society by and about Steinmetz. Includes reminiscences of contemporaries, the restoration of his electric car by Union College, some group photographs, clippings relating to Camp Mohawk and his home in the GE Realty Plot, which was torn down in 1946 after a failed attempt to convert it into a historic site. The family folder contains correspondence between Steinmetz and his family, originally in German, and with partial English translations and family photographs. Some of the items in the family folder may have been removed from the collection at one time. For additional information on Steinmetz in the pamphlet file, also consult the Union College and General Electric folders in the file.

Pamphlet File, Steinmetz, Charles, 6 folders

1) Articles (about):
   a) "Charles Proteus Steinmetz: A Great Civic Leader, Educator, and Humanitarian," by Hawley B. Van Vetchen, 1941
   b) "Charles Proteus Steinmetz, Personal recollections from the early youth of the great electrical engineer," by Dr. G. F. Moser (tutored by Steinmetz), November 1923
   c) Union College press release regarding restoration of Steinmetz Electric Car
   d) Letter, Walter Price, University of Wisconsin to Elsa Church, Schenectady County Historical Society. Price was a neighbor of Steinmetz's in Glenville camp
   e) Papers heard at 76th anniversary of Steinmetz's birth, Rice Hall, GE, April 9, 1941. Includes George Lunn, William Efner, Clyde Wagoner, Laurence Hawkins, John Dempster, and Emil Remscheid
2) Old finding aid to the collection

3) Homes: **Photographs**, clippings, material relating to Steinmetz Memorial Fund, to convert house into museum
4) His camp: Clippings, **photographs**
5) **Group photographs:**
    a) With Elbert Hubbard
    b) As a college student in Germany (A78931)
    c) With Douglas Fairbanks and Hayden children during California trip
    d) Steinmetz and Edison
6) Miscellaneous:
    a) Clippings of people who knew Steinmetz, including his barber, a neighbor, and Cecile Rhein
    b) In bag, notes for an article about Steinmetz
    c) Notes, Eugene F. Roeber, Hoboken, N. J., "Remarks on Steinmetz's theory and calculation of AC Phenomena"
    d) One Steinmetz's checks
    e) Letter, Joseph A. Thomas-Hazell, question about Steinmetz and memories of career at Research Lab and African-Americans at the Research Lab
    f) Clippings of electric car restoration
    g) Clipping and photo of Steinmetz at Ostrich Farm in California. Last photo taken of him
    h) Bickleman's reminiscences of Steinmetz living with them until he could get a room at the Franklin Hotel on Liberty Street. Steinmetz visited Mr. Bickleman to talk and improve English
    i) Clippings, Steinmetz Middle School Hall of Heroes, 1984
    j) Union College clipping regarding E. A. Jones, head of GE Photographic Department and GE's most popular photograph, Steinmetz and Edison
    k) Copy of 1946 petition to have a park named after Steinmetz

Steinmetz Family Folder
1) Clippings
2) Klara Steinmetz photo, 1893, colored, Breslau
3) Excerpts from will
4) Correspondence, 1888-1889, with father and other family members. Letters partially translated. Includes 1890 letter Steinmetz wrote to his father, the last one before his father's death
5) Portrait of Steinmetz with Haydens, 1909-1910
6) Clipping, On Meeting Steinmetz's granddaughter, Gazette, April 1, 1901
7) Photographs:
    a) Steinmetz and Edison, taken by Henry R. Kelly of Laboratory staff
    b) Steinmetz with ostrich
    c) Lord Kelvin group portrait
    d) Signed photo of Steinmetz working at table (without cigar), sent to Davis T. Eickemeyer

Photographs to be removed to Series 1
See also pamphlet file under General Electric, Union College

Not Steinmetz:

GE Turbine Control Diagram, made by J.W. Edmonds, November 15, 1961, for Potomac Electric Co., Chalk Point, MD #1 and 2 (Moved temporarily to the back of Box 3).

Also in Library Collection:
Small Orange Box labeled Steinmetz tools, includes red metal block, miniature saw, coil chisel, miniature rotary saw block, other small metal tools