NATIONAL ACADEMY OF SCIENCES

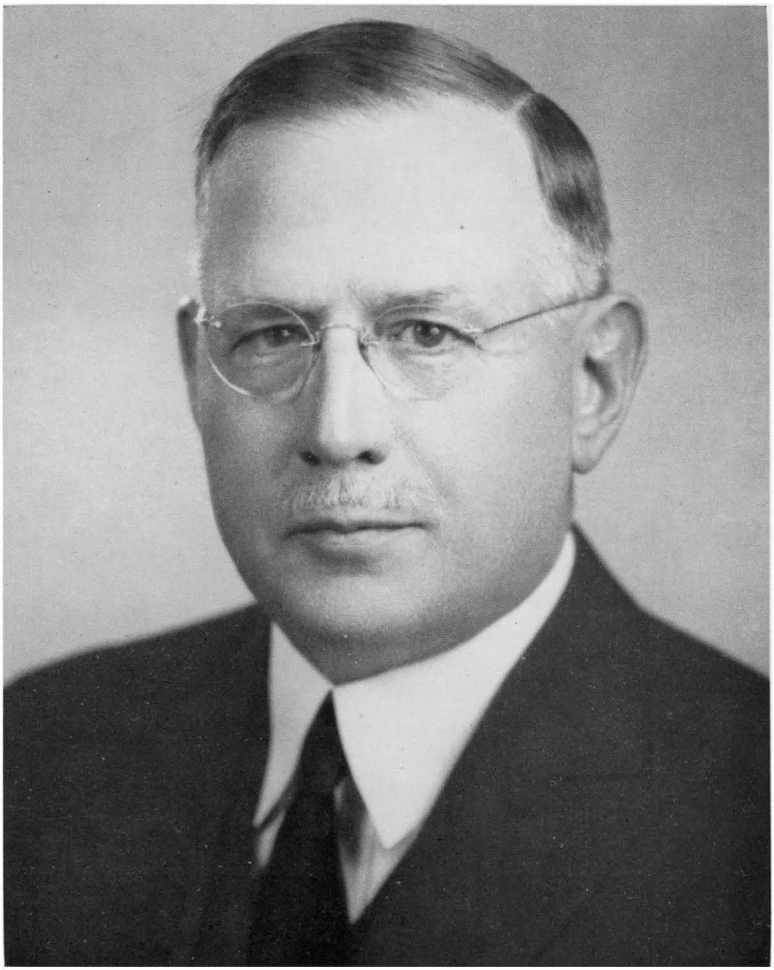
GANO SILLICK DUNN

1870—1953

A Biographical Memoir by

VANNEVAR BUSH

Biographical Memoir



Geo Dunn

GANO SILLICK DUNN

1870–1953

BY VANNEVAR BUSH

Gano Dunn was born in Yorkville, New York, October 18, 1870, the son of N. Gano Dunn and Amelia Sillick Dunn. His grandfather, Nathaniel Dunn, a school teacher and inventor, who attended Bowdoin College with Longfellow and Hawthorne, probably stimulated the younger Gano's bent for construction and engineering.

Dunn's father died before Gano had finished his education; and at the age of fifteen he began to work for the Western Union Telegraph Company, as an operator, in order to continue his schooling at the College of the City of New York. It was while he was still attending City College that Dunn had the extraordinary experience of visiting Thomas A. Edison in his laboratory. He later told of this experience when he received the Edison Medal for 1937, "Out of an almost infinite kindness for young men who were struggling," he said, "Mr. Edison received me in the midst of some laboratory work he was doing in the coating of laminated armature plates. Seeming to be interested in the questions I asked him, he drew me out in turn, and spent an hour personally showing me over his lamp works. . . . At the end of the visit, he offered me a job." Dunn did not accept the job, and Edison later admitted that Dunn had done the right thing in staying on to complete his college course.

In 1889 Dunn received his B. S. degree from City College and was honored by election to Phi Beta Kappa. He then enrolled in the newly established postgraduate electrical engineering course at Columbia University under Francis B. Crocker and Michael Pupin, and in 1891 received the first degree in electrical engineering ever given by an American university. Pupin later said that Dunn was the most versatile and gifted of all his students, and Crocker thought so highly of him that in 1891 he took him on first as an apprentice in his Crocker-Wheeler Electric Company and subsequently promoted him to assistant engineer, chief engineer, vice president, and director.

Dunn was only twenty-eight years old when he became vice president and chief engineer of Crocker-Wheeler. He was

placed in charge of the designing of electrical apparatus for both direct and alternating current, and he also supervised all of the scientific and technical work of the company. In developing his designs Dunn made very careful preliminary studies, investigating exhaustively all theoretical considerations, so that it was rarely necessary to make subsequent changes except, of course, when in the light of engineering progress designs for new machines had to be developed. And he had an eye for the aesthetic values in his designs.

While he was with Crocker-Wheeler he received the degree of Master of Science in 1897 from City College, submitting as his thesis "The Distribution of Electric Power in Factories." His interest in this subject redounded, no doubt, to the high reputation of Crocker-Wheeler in the field of electric motor drive. Among his specific contributions to the company's success were innumerable unpatented inventions and improvements in design and construction. He also registered many patents, which brought profit to the company. In 1911 he was offered the presidency of the firm but decided not to take it, preferring to move on from the field of manufacturing engineering to that of consulting and construction.

James Gilbert White, founder and head of the J. G. White and Company, was at the time looking for a vice president to take charge of engineering and construction for his company and was so impressed with Dunn's work that he offered him the position. Dunn accepted and, after helping to organize the company, he became its first president in 1913 and held the position until his death on April 10, 1953. The J. G. White Engineering Corporation, now one of the oldest consulting and construction engineering firms in the country, built under Dunn's guidance vast projects all over the world for both public and private agencies. Among these projects in the United States were the first long-distance natural gas pipe line in California; the Lake Ontario Ordnance Works for the manufacture of TNT; the original Government aviation station at Langley Field, Virginia; the 60,000 kilowatt steam station at Muscle Shoals now operated by the TVA; the Naval Ordnance Plant in Louisville, Kentucky; and manufacturing plants in Syracuse for the production of marine turbines and radar equipment.

The company also built the United States Government Airport on the Island of Fernando do Noronha off the coast of Brazil, the United States Naval Oil Base at Pearl Harbor, and enormous sulphur-extraction plants and oil refineries; and it even renovated and redecorated the Metropolitan Opera House in New York with new stage and house lighting, modern switchboard controls, ventilating, and air conditioning. It carried out a program of constructing roads, bridges, and irrigation works for the republic of Haiti, for which Dunn was decorated with the Order of Honor and Merit of the republic of Haiti. It also constructed three large irrigation and power dams in Chile and five in Mexico, power plants in Colombia, the Chiriqui railroad for the republic of Panama, and a 20,000 kilowatt power plant to pump oil from under water off the shores of Lake Maracaibo in Venezuela.

In 1940 the National Association of Manufacturers most appropriately bestowed upon Dunn their Modern Pioneer Award, and in 1947 the Pan-American Society of the United States, of which he was an Honorary President, presented him with its Gold Insignia.

For the Radio Corporation of America the J. G. White Engineering Corporation, under Dunn's direction, built thirteen transoceanic radio stations. Early in his career, Dunn had attended Institutes of the Radio Corporation of America and had received a first-class commercial radio operator's license. This training was to serve him well in later years when in an emergency he was able to receive and relay an S.O.S. message for a ship that was in trouble in the Pacific Ocean. Dunn met David Sarnoff when the latter as chief inspector of the Marconi Company represented his company in connection with the erection of the first transatlantic radio tower. In 1938 Dunn became a Director of the Radio Corporation of America and Sarnoff, Chairman of the Board, said in connection with his appointment, ". . . I wanted him because more than any other man living, Dunn brings poetry into science and engineering. I can explain that best by saying that if I ask a good engineer to explain a new circuit of some sort, I get an accurate description in suitable technical terms. But if I ask Dunn to describe it, I get an explanation of the relationship of that circuit to other

devices, an estimate of its possible uses and a prophetic glimpse of the developments to which it's apt to lead." One of the last trips taken by Dunn just a month before his death was for the purpose of learning about RCA installations in California.

The greater part of Dunn's life was lived as a bachelor and as a widower. He was fifty years old when in 1920 he married Mrs. Julia Gardiner Gayley. Mrs. Dunn died in 1937.

Dunn was always generous in the devotion of his time and energy to the needs of Government.

Before the first World War he served as the power expert member of the War Department's Nitrate Commission, and in this capacity he made studies of the Tennessee River with reference to its suitability as a source of power for the manufacture of nitrates.

In 1919 he was appointed Chairman of an interdepartmental committee established by the State Department to investigate the possible disruption of communication with our Allies and our military forces in Europe that might result from the cutting of transoceanic telegraph cables. The committee made a thorough study of the problem and worked out procedures for effecting communication in the event of an emergency. Luckily, the emergency did not develop.

Dunn was active on a number of other Government committees. In 1923 he was appointed a member of the Visiting Committee of the Bureau of Standards and continued to serve on it for twenty-five years. The late President Roosevelt appointed him a member of his Science Advisory Board, 1932-1936. He was the United States delegate and member of the Executive Committee of the World Power Conference in 1936, a member of the President's Committee on Civil Service Improvement from 1939 to 1941, a member of the Patent Office Advisory Committee from 1939 to 1941, Chairman of the American Committee of the World Power Conference from 1946 to 1952, and one of the advisers of the Public Works Task Force of the Hoover Commission on Organization of the Executive Branch of the Government.

Dunn at first opposed the Government's policy of developing the Tennessee Valley Authority in competition with private utilities, and in the lawsuit to test the constitutionality of the

Tennessee Valley Act, his firm was engaged by the Commonwealth and Southern Corporation to give expert testimony against the Government's position. But in 1940 he reversed his position and strongly recommended increasing the power capacity of the Tennessee Valley Authority on the grounds that it was necessary for the national defense.

In January and February 1941, at the request of President Roosevelt, Dunn made an exhaustive survey of the capacity of the steel industry to determine whether it had adequate facilities to meet the combined requirements of the United States and British defense programs as well as the expanded demands for civilian uses. He was at the time senior consultant to the Production Division of the Office of Production Management, but in this instance he made his report directly to the President.

The study was requested by the President because of conflicting estimates of steel requirements for the next two years and of the ability of the industry to meet all demands placed upon it. This question was of such importance to the defense program and the national economy as a whole that the President called upon Dunn, as a qualified authority capable of presenting an impartial, factual study, to make a special report on the subject. In the course of his initial investigation, which was carried out over a period of six weeks, Dunn consulted with a great many economists and experts, both in government and in industry, and representatives of organized labor in the steel industry. His first report was made in February. But in view of the importance of steel capacity and the necessity of having an up-to-date picture of the situation, the President asked him to regard this report merely as the starting point of a continuing study. Dunn accepted the assignment and undertook to revise his statistics and conclusions periodically.

His first report was strongly criticized as too optimistic by some of the Government's economists; and in a second report, presented to the President in May 1941, Dunn revised his estimates radically and concluded that the steel producing capacity of the nation was far from adequate to meet the increasing military demands. He questioned, however, whether the available labor supply was sufficient to expand the industry and pointed to the curtailment of civilian steel consumption as

the only feasible way of meeting the situation.

Dunn participated in the affairs of New York State and City no less than in those of the nation. He served as a consultant in 1941 to the New York City Housing Authority. He was a member of Mayor LaGuardia's Business Advisory Committee, a member of Governor Dewey's Temporary Committee on the Need of a State University and a member of his Technological Advisory Committee, one of three engineers appointed by the City Planning Commission during Mayor O'Dwyer's administration to make a survey and prepare a report on "Selected Measures for the Partial Relief of Traffic Congestion in New York City," and a member of the New York State Committee on Technical Industrial Development.

Among his many public services, one which was perhaps the closest to his heart, as it was certainly one of his most continuous endeavors, was his association with The Cooper Union for the Advancement of Science and Art. In 1925 he was appointed one of the five trustees of The Union and ten years later became their president, in which capacity he continued to serve until his death. One of his first acts as president of the trustees was a survey of the Union's activities in the light of its founder's purposes. Under his direction the Engineering School became a leader in giving the social sciences and the humanities a place in the professional education of engineers, and the Arts School embarked on a program of art education as distinct from mere training in technical skill. Dunn guided the investment policies of the endowment and was instrumental in increasing its income. At the 90th Commencement exercises of The Cooper Union in 1950 he was awarded the Peter Cooper Medal with a citation that read in part, "These fellow New Yorkers, Peter Cooper and Gano Dunn, separated by almost a century in time, have achieved in their individual ways great distinction in the application of science to the practical problems of life. In the character of both men are combined innate kindness and great integrity with creative inquisitiveness and incisive thinking. And they both have devoted themselves to the furtherance of the American ideal of equal educational opportunity for all people of whatever race, creed, or color."

Dunn was a trustee of Barnard College from 1922 until his death and a member of the Visiting Committee of the Harvard Engineering School from 1935 to 1951.

Columbia University honored him with the degrees of Master of Science in 1914 and Doctor of Science in 1938 and with the Egleston Medal in 1939; Rutgers in 1938 and New York University in 1941 conferred upon him Honorary Doctor of Science degrees. In 1933 his Alma Mater, the College of the City of New York awarded him the Townsend Harris Medal and in 1947 gave him an Honorary Doctor of Science degree. Lehigh University granted him an Honorary Doctor of Engineering degree in 1942 and Bowdoin College an Honorary Doctor of Laws in 1947 as America's "Engineers' Engineer."

Dunn took great satisfaction in the work of the American Institute of Electrical Engineers, serving on its governing board as a manager and vice president and as president, 1911-1912. From 1913 to 1916 he was president of the United Engineering Societies, an organization which he helped to start, and on whose board he was a member for many years. He played a prominent part in the organization of the Engineering Foundation, doing much to help secure endowments and acting as its first chairman from 1915 to 1916. Honorary membership was accorded him by the Association of Iron and Steel Engineers in 1912, the American Society of Mechanical Engineers in 1944, the American Institute of Electrical Engineers in 1945, and the American Society of Civil Engineers in 1949. He was also a member of important engineering organizations abroad. He was elected a member of The Institution of Electrical Engineers of Great Britain in 1911 and was appointed its Honorary Secretary in the United States in 1922. In recognition of his outstanding contributions to the field of engineering, Dunn was awarded the Edison Medal for 1937 and the Hoover Medal for 1939.

In addition to his engineering associations he was a member of numerous scientific, cultural, and intellectual groups, including the Franklin Institute, the American Philosophical Society, the American Academy of Arts and Sciences, the New York Historical Society, the Optical Society of America, and the New York Zoological Society. He was a Fellow of the New York

Academy of Sciences, the Institute of Radio Engineers, the American Association for the Advancement of Science, the Royal Microscopical Society of London, and the New York Microscopical Society. Dunn also belonged to several distinguished social clubs, among them the Union, University, Century, Knickerbocker, Tuxedo, Engineers—all of New York City—and the Cosmos Club of Washington, D. C.

Dunn was elected to membership in the National Academy of Sciences in 1919. When the National Research Council was organized in 1916, he became its first vice chairman and subsequently served as chairman from 1923 to 1928. Some members may recall the address he delivered on April 28, 1924, as Chairman of the Building Committee when he turned over to the National Academy of Sciences and the National Research Council the beautiful building which now houses their activities.

Of all his talents, perhaps the most fruitful was his ability to inspire confidence in all with whom he had to deal. And in consequence of this talent he invariably found himself pushed forward to a position of leadership in every group or organization to which he belonged. To quote a *New York Times* editorial of April 14, 1953, Dunn was "an outstanding leader in his profession, a man of deep integrity and a fine example of a public-spirited citizen." Bancroft Gherardi in awarding him the Edison Medal said of him that, "Combined with straight thinking and with frankness, which many engineers possess, he had diplomatic abilities of no mean order."

Raymond Moley compared him to Francis Bacon, saying ". . . there is something about his influence that suggests the role of that man of universal learning in the court of Queen Elizabeth. There is the hint of the sorcerer about Dunn—not the sorcerer of Disney's Fantasia, but the Elizabethan master of subtle mysteries. In twentieth-century terms, Dunn is a man who might push back impeccable cuffs and, to amuse his dinner guests between courses, repair a lagging chronometer or whip together a complete radio set. More astonishing than even such bits of legerdemain are the color and flashing opulence of his knowledge. Explanations of atomic power, coaxial cables and the uses of manganese in steelmaking are the kind of intellectual fare he sets forth for his friends. His mind moves joy-

ously among the miracles of an age that has never grown tired of producing miracles and exploring the miraculous."

He was especially zealous in promoting the idea that engineering is a social art and that engineers to be wholly effective must be conscious of all the social values of their time. He defined engineering as "the art of the economic applications of science to social purposes," and in 1930 he declared in an address before the Alumni of Columbia University, "And if his [an engineer's] training neglects the great human mirrors of history and languages, particularly his own language, if his mind and his heart are insensible to the great social forces, if he but feebly develops the subtle qualities of character that make for personality, his career as an engineer is limited, no matter how much science he knows."

Many of the physical achievements of Gano Dunn will live for generations as a monument to his greatness. But the one that he probably valued above all others was his very great accomplishment in humanizing the art of engineering.

KEY TO ABBREVIATIONS USED IN BIBLIOGRAPHY

Am. Soc. Mech. Eng. = American Society of Mechanical Engineers
Assoc. Iron & Steel Electr. Eng. = Association of Iron and Steel Electrical Engineers
Concrete and Constr. Eng. = Concrete and Constructional Engineering
Electr. Eng. = Electrical Engineering
J. Eng. Ed. = Journal of Engineering Education
Mech. Eng. = Mechanical Engineering
Proc. Am. Inst. Electr. Eng. = Proceedings of American Institute of Electrical Engineers
Proc. N. Y. Electr. Soc. = Proceedings of New York Electrical Society
Science Mon. = Science Monthly

BIBLIOGRAPHY

1894

Direct Current Motor and Dynamo Design. Address presented before the N. Y. Electr. Soc., November 27. Electricity, Pt. I, vol. 7, no. 22, 258-259; Pt. II, vol. 7, no. 23, 272-274; Pt. III, vol. 7, no. 24, 281-283.

1910

First Cost and Operating Efficiency of Mixed Versus Exclusively Alternating Systems in Steel Mills. Minutes, 4th An. Con., Assoc. Iron & Steel Electr. Eng., October, 65-72.

1912

The Relation of Electrical Engineering to Other Professions. Address presented at the 29th An. Con. of Am. Inst. Electr. Eng., Boston, June 25. Proc. Am. Inst. Electr. Eng., vol. 31, no. 8, 1721. Also in Science, vol. 36, no. 919, 161-166.

1916

The Waterpower Situation, Including Its Financial Aspect. Read at the 321st Meeting of the Am. Inst. Electr. Eng., Washington, D. C., April 26. Proc. Am. Inst. Electr. Eng., vol. 35, no. 12, 575.

1921

Why Limit the Opportunities of the Professional Engineer: Report to the Professional Engineers who signed the Petition of March 21, 1921, to the Senate and Assembly of the State of New York in Support of Senate Bill No. 716 Known as the Engineers Bill. (Now Chapter 581 of the Laws of 1921.)

1923

Building of the National Academy of Science. Science, vol. LVIII, no. 1503, 298-299.

1924

Address on Turning Over Building of the National Academy of Sciences and National Research Council to President of the Academy. Science, vol. LIX, no. 1532, 409-410.

1927

Management's Contribution to Prosperity in Industry. Address presented at Nat. Meeting of the Am. Soc. Mech. Eng., Management Div., Chamber of Commerce, Rochester, October 26. Mech. Eng., vol. 49, no. 12, 1285-1287. Also in Abrasive Industry, vol. 9, no. 5, (1928) 129-130.

1930

The Relationship Between Science and Engineering. Address presented to Alumni of Columbia U., New York, February 12. Science, March 14. Mech. Eng., vol. 52, no. 6, 595.

1932

(With A. W. Legat) Ideal Bridges. Concrete and Constr. Eng., vol. 27, no. 10, 551-559.

1934

Early Headquarters of Institute. On occasion of 50th Anniversary of Am. Inst. Electr. Eng. Electr. Eng., vol. 53, no. 5, 685.

Statics of Bridge Design. Concrete and Constr. Eng., vol. 29, 15-35; 153-163; 303-304; 429-443; 523-530; 580-596; 732-744.

1935

Statics of Bridge Design. Concrete and Constr. Eng., vol. 30, nos. 3 and 5, 175-191; 285-292.

1937

The Engineering Profession. Address presented at 70th Commencement of Massachusetts Institute of Technology, Boston, June 8. Electr. Eng., vol. 56, no. 10, 1235-1238.

Response upon Award of the Edison Medal. Proc. Am. Inst. Electr. Eng., vol. 51, no. 3, 128-129.

1939

Dr. Frank B. Jewett, President of National Academy of Science. Science Mon., vol. 48, 566-568.

1940

Public Service. Address on the occasion of the presentation of the Hoover Medal, New York, January 24. Electr. Eng., March, 95-99.

1941

Report to the President of the United States on the Adequacy of the Steel Industry for National Defense. February. Second report in May.

Significance of the Laboratories. Address at the laying of the corner-stone of Radio Corporation of America laboratories. Princeton, New Jersey, November 15.

1944

The Importance of the Humanities in an Engineering Education. J. Eng. Ed., vol. 34, no. 5, 443-444.

1945

(With Fenton B. Turck and Morehead Patterson) Comments on Engineers' Role in Distribution. Presented as part of program of 1944 Am. Soc. Mech. Eng. An. Meeting, November 28. Mech. Eng., April, 244-246.

1946

(With V. R. Clark) Notes on Pressure Surveying, With Particular Reference to Installation of Inbye Fan. Iron and Coal Trades Review, vol. 152, no. 4069, 335-342, and no. 4079, 787-791, 798.

1948

(With A. W. Legat and W. A. Fairhurst) Design and Construction of Reinforced Concrete Bridges. Concrete Publications, London.

1949

Peter Cooper—A Mechanic of New York. The Newcomen Society in North America, Princeton University Press.

PATENTS

UNITED STATES:

Patent Number	*Date Issued*	*Title*
27,098	May 25, 1897	Frame for Dynamo.
493,375	March 14, 1893	Mechanical balancing of armatures of dynamos or motors.
515,755	March 6, 1894	Automatic brake for motors.
549,061	October 29, 1895	Speed control of constant current motors.
591,343	October 5, 1897	Indirect voltage regulation of dynamos.
591,344	October 5, 1897	Constant current regulation of dynamos.
591,345	October 5, 1897	Constant current regulation of dynamos.
601,871	April 5, 1898	Electromagnetic circuit breaker.
618,853	February 7, 1899	Brush holder for dynamo electric machines.
638,627	December 5, 1899	Multiple blade starting switch.
654,142	July 24, 1900	Brake.
662,375	November 20, 1900	Multiple voltage controller for motor operation.

735,352	August 4, 1903	System of electrical distribution for multiple voltage.
736,587	August 18, 1903	System of multiple voltage supply for motors.
754,980	March 22, 1904	System of speed regulation for motor-driven machinery.
768,738	August 30, 1904	Motor generator frame.
783,999	February 28, 1905	Commutator brush for direct current dynamos.
784,000	February 28, 1905	Commutator brush for direct current dynamos.
792,762	June 20, 1905	Brush rigging for dynamos.
797,271	August 15, 1905	Switch for controlling motor speeds.
839,060	December 18, 1906	Machine for bending metal strips edgewise.
855,237	May 28, 1907	Belt tightening idler.
879,949	February 25, 1908	Coil retainer for dynamo electric machines.
893,228	July 14, 1908	Pole structure of dynamo to reduce vibrations.
918,425	April 13, 1909	Method of bending metal strips edgewise.
922,107	May 18, 1909	Brush rigging for dynamos.
1,006,370	October 17, 1911	Lubricating device for journal bearings.
1,013,753	January 2, 1912	Sheet-metal punchings for squirrel cage motor.
1,104,784	July 28, 1914	Dynamo electric machine frame.
1,104,785	July 28, 1914	Multiple motor control system.

GREAT BRITAIN:

3,919	1904	Improvements in system of speed regulation for motor-driven machinery. (Corresponding to U. S. Patent no. 754,980)
9,874	1904	Improvements in electric-switches. (Corresponding to U. S. Patent no. 797,271)
12,400	1900	Brake. (Corresponding to U. S. Patent no. 654,142)
13,779	1904	Improvements in electrical distribution particularly applicable for controlling electric motors. (Corresponding to U. S. Patent no. 735,352)
23,296	1897	Indirect regulation of dynamo-electric machinery. (Corresponding to U. S. Patents no. 591,343, no. 591,344, no. 591,345)

24,186	1899	Multiple blade starting switch. (Corresponding to U. S. Patent no. 638,627)
26,193	1906	Improvements in machines for winding metal strips edgewise. (Corresponding to U. S. Patent no. 839,060)

CANADA:

87,803	June 14, 1904	Improvements in system of speed regulation of electromotor-driven machinery. (Corresponding to U. S. Patent no. 754,980)
89,516	October 11, 1904	Improvement in electric switches. (Corresponding to U. S. Patent no. 797,271)
103,309	January 29, 1907	Machines for bending metal strips edgewise. (Corresponding to U. S. Patent no. 839,060)