BIOGRAPHICAL SKETCH

J. A. L. WADDELL, D.Sc., D.E., LL.D.

DESIGNING, CONSTRUCTING, AND CONSULTING ENGINEER, INVENTOR, AUTHOR, LECTURER, ALTRUIST, AND SPORTSMAN

" 'Twas certain he could write and cypher, too." The annals of Civil Engineering, especially of Bridge Engineering, would be conspicuously incomplete without due recognition of the contributions made to the engineering profession by more than half a century of continuous services of ever-increasing magnitude that have been rendered to the profession, to the public, and to his clients and associates by Dr. J. A. L. Waddell, who has had a larger part than any other individual in the development of the art and science of Bridge Design and Construction, and in the initiation and elaboration of many improvements of technique, of theory, of method, type, detail, and application in both technical and economic directions.

His broad interests, his numerous and varied engagements in America and foreign countries, his extensive researches, his many important constructions, novel developments, and successful enterprises, the high reputation he has won, and the distinguished recognitions that he has received, both at home and abroad, make him conspicuously the Dean of Bridge Engineers the world over.

His ceaseless devotion to the needs and opportunities of his profession, his indefatigable efforts for the improvement of technical training, and the according of recognition, emoluments, dignity, and influence (commensurate with their abilities, responsibilities, and achievements) for his fellow professionals, have made him foremost among the conspicuous group of engineers who, within the last two generations, have practically created the art and advanced the profession of Civil Engineering throughout the world.

Those engineers have placed American Bridge Engineering notably in advance of all construction developments. They have put and kept American Bridge Designers, Fabricators, and Erectors at the undisputed summit of their art, as abundantly demonstrated by the fact that all the American bridges, the greatest and best in the world, and many of the most important and difficult of foreign structures, have been created, their most intricate problems solved, and their dangerous constructions executed by American Engineers. Leadership in such achievements is a distinction high on the rolls of Genius, Manhood, Professional Skill, and the service of Human Endeavor and Permanent Betterment.

Dr. Waddell's life has very consistently illustrated the ever-increasing quality, number, and magnitude of results that it is possible to attain by persistent determination and the genius of continued hard work, co-ordinated with ambition, keenly developed judgment, and ceaseless energy, systematically applied to the preservation and efficient recording and tabulation of results, so as to avoid repetition of effort, and so as to build large successes on smaller ones with an endless chain of opportunities and accomplishments rationally extended, in many directions, from their predecessors.

While he has been progressive, sometimes almost to the point of being revolutionary, he has yet been conservative, in that all his advances were justified and were made on well-proved facts, never on experimental hazards.

Always a deep student and a clear and accurate thinker, he has logically advanced from one new or extended point to another, and, more than any of his contemporaries, has clearly defined, explained, and recorded his investigations and constructions, and invariably has put important examples into such form as to be most convenient and useful for application or modification by other engineers, thus richly repaying to his profession the opportunities and distinctions which it has bestowed on him.

His contributions to technical societies, to engineering literature, to the theory and practice of steel construction, and his uncounted bestowals of deep thought and earnest counsel for the higher, broader, and more efficient training of the engineering student are high points in the profile of his career.

The main features of his preparation, development, and activities and the milestones in his professional pathway are indicated by the following outline of his life-work and the enumeration only of some principal or outstanding achievements, identifying the volume and character of all the rest.

John Alexander Low Waddell was born at Port Hope, Ontario, Canada, January 15, 1854. His father, Robert Needham Waddell, was born at Newry, Ireland, in 1813, and came to Canada in 1829. His mother was a daughter of the late Colonel William Jones of the Seventh Regiment of New York, once Sheriff of New York City, and again a member of the state legislature.

Taught by his mother until his ninth year, young Waddell then attended the public school at Port Hope for two years. In 1865 his father was appointed High Sheriff of the United Counties of Northumberland and Durham and removed to Cobourg, where John prepared for Trinity College School in Port Hope, which he attended until his sixteenth year when, on account of rather delicate health, the effect of hard study, he was sent to China as a passenger on the noted tea-clipper, "N. B. Palmer" of New York, and was much benefited by the ten months' voyage to Hong Kong, Shanghai, and return.

He next spent five months at a business college in Toronto, and late in the fall of 1871 matriculated at the Rensselaer Polytechnic Institute, Troy, New York, where he graduated with the class of '75, and soon after commenced work as a draftsman in the Marine Department of the Dominion at Ottawa, Canada, where he spent a few months designing buoys, lanterns, and similar marine appliances.

Thence he entered the service of the Canadian Pacific Railway, and served as rodman and instrument man for more than a year on preliminary, location, and construction work, principally near Port Savanne. He resigned from this position to work for sub-contractors who were building sections of the road. After the completion of this job, he obtained employment on the bridge over the Missouri River, at Glasgow, Missouri, but the great heat and malaria impaired his health, and forced him to give up the work after only a month of service. Soon afterwards he secured the position of engineer for a coal-mining company in West Virginia, where he surveyed the entire property both above and below ground, and designed and built a ventilating shaft and furnace and other mine structures.

In the fall of 1878 he became, first, Assistant to the Professors of Geodesy and Descriptive Geometry at the Rensselaer Polytechnic Institute, and later Assistant to the Professor of Rational and Technical Mechanics.

In January, 1881, he was appointed Chief Engineer of Raymond & Campbell, Bridge Builders, Council Bluffs, Iowa.

On July 13, 1882, he married Miss Ada Everett, the only daughter of Horace Everett, Esq., of Council Bluffs; and, soon after, the bride and groom and his sister, Miss Josephine Waddell, sailed for Japan, where he occupied the Chair of Civil Engineering in the Imperial University of Tokyo. In the intervals of his university duties, Prof. Waddell wrote his first book, "The Designing of Ordinary Iron Highway Bridges," which was widely accepted as a standard text book until 1899, when, at the Author's request, it was declared out of print, because wrought iron, with which it dealt, had been commercially displaced by structural steel, greatly changing bridge building.

Immediately after the publication of this book, the preparation of "A System of Iron Railroad Bridges for Japan" was begun at the request of the University authorities. This monograph was published early in the summer of 1885, and contained several criticisms of the methods of English engineers, as they were exemplified in the Japanese railway bridges, most of which were of English design and fabrication. The "Japan Mail" reviewed the monograph; and immediately its author was bitterly attacked in numerous letters addressed to the "Mail." For nine months the discussion was exclusively personal on the part of the English engineers. A number of Japanese engineers, an American engineer, Professor W. C. Kernot of the University of Melbourne, and Prof. Waddell carried on the scientific side of the argument, which gradually

took on a more technical character and resulted in completely establishing the soundness of the memoir.

In 1886, after four years of University work, for which a little later the Emperor decorated him with the order of the Rising Sun and the rank of Knight Commander, Prof. Waddell returned to America and spent five months in the bridge works at Phoenixville, Pennsylvania, preparing competitive designs and estimates for several important bridges, and studying the manufacture of metalwork.

On January 1, 1887, he opened an office in Kansas City, and, from the first, was successful in obtaining both contracts for the companies he represented and engagements as a consulting engineer. As agent for The Phoenix Bridge Company, he secured in competition an elevated railroad connecting the Merchants' Bridge and the Union Depot in St. Louis, and the Red Rock Cantilever Bridge over the Colorado River between California and Arizona on the line of the Atlantic and Pacific Railway. Immediately afterwards he was retained by that railway company as its Consulting Engineer, to supervise the detailing at Phoenixville of the said Red Rock Bridge. At the time of its construction this was the longest cantilever span in America.

In 1892, he resigned the agency for The Phoenix Bridge Company and The Phoenix Iron Company, and thenceforth devoted himself entirely to consulting work.

On January 1, 1899, his principal assistant engineer, Mr. Ira G. Hedrick, was admitted to partnership; and the firm became known as "Waddell & Hedrick."

In 1892 he was appointed Chief Engineer of the Pacific Short Line Bridge Company, for which he designed and supervised the construction of a combined railway and highway bridge over the Missouri River at Sioux City, Iowa, with two 500-foot fixed-spans, two 470-foot swing-spans, and the approaches.

As Chief Engineer of the Omaha Bridge and Terminal Railway Company, he designed in 1893 a double-track-railway bridge across the Missouri River at East Omaha, Nebraska, that ultimately had two 520-foot swing-spans, the largest that had then been built.

In 1893 a lift bridge of unprecedented dimensions carrying South Halsted Street over the South Branch of the Chicago River, was designed and constructed by him for the City of Chicago, embodying many features that have since become standard.

A steel highway bridge across the Missouri River at Jefferson City, Missouri, also designed and engineered by him, has steel cylinder piers supporting a 440-foot swing-span, two 350-foot fixed-spans, and the approaches.

In 1893 he was retained as Consulting Engineer for the Northwestern Elevated Railroad and the Union Loop Elevated Railroad of Chicago, together comprising about six miles of four-track structure built on private

right of way, about one mile of two-track structure built in the street, and nearly three miles of double-track structure forming a complete loop around the most congested business portion of the city. The results of extended preliminary investigations for this construction were recorded by him in a paper presented to the American Society of Civil Engineers in 1896, which paper then set a standard for subsequent elevated-railroad construction. As a result of this experience, he was made Advisory Engineer on the Elevated Railroad System of Boston.

Remarkable among the many structures that the Author has built, is one of very difficult design and erection over the Fraser River, at New Westminister, B. C., which has a long Y-span, of which the two diverging trusses, rigidly connected to each other, were floated to position in the most daring and unprecedented manner, but with complete safety and success, thus surmounting an apparently hopeless obstacle, and saving a large amount of money over other possible methods. To add to the difficulties of this construction the foundations for some of the piers were carried far below the possibility of pneumatic caissons (to a depth of nearly 160 feet) by the open-dredging process. This work was conducted through 80 feet of water, where the daily tidal current was five miles an hour in each direction.

Many other bridges were designed by him throughout the United States, Canada, and Mexico, and for Cuba, New Zealand, Russia, and Japan.

Many important difficulties of inland navigation were solved by the Author with his eminently successful development of the lift bridge, providing much greater vertical and horizontal clearances, so as to permit the passage of the tallest-masted vessels under normally low-level structures. This lift bridge is the most desirable type for many locations.

Examples of it are shown in approximately chronological order in the bridges at South Halsted Street, Chicago; Hawthorn Avenue, Portland, Oregon; the Fratt Bridge over the Missouri River, at Kansas City, Missouri; the Chicago River Bridge of the Pennsylvania Railroad Company; two bridges over the Calumet River, near Chicago, for the Pennsylvania Railroad and the Lake Shore and Michigan Southern Railroad; two bridges in Montana for the Great Northern Railroad; the double-action vertical lift over the Willamette River at Portland, Oregon; the Pacific Highway Bridge over the Columbia River between Portland, Oregon, and Vancouver, Washington; the Louisville Bridge of the Pennsylvania Railroad Company; the Portsmouth, New Hampshire, Highway Bridge; four spans in the bridge lately completed over Newark Bay for the Central Railroad of New Jersey; a double-deck railway and highway lift-span for Bath, Maine, and about fifty minor structures of the same type scattered throughout the United States and Canada: a remarkable list of special spans up to 300 feet, all of which have proved safe, dependable, and economical, assuring the greatest continuity and rapidity of both maritime and land traffic. Dr. Waddell has figured bridges of this type up to 560-

foot span, and has found no obstacle to prevent their construction to that length or even greater lengths.

On January 1, 1907, Mr. John Lyle Harrington, a former employee of the Author's, took Dr. Hedrick's place, the new firm being known as "Waddell and Harrington."

In 1907 Dr. Waddell was made Vice-President and Principal Engineer of the Trans-Alaska-Siberian Railway Company, organized to construct several thousand miles of trunk railroad from European Russia through the entire width of Siberia, in tunnel under Bering Strait and through Alaska and Canada to connect with the United States Railway System. After considerable investigation and extensive preliminary work, this project was abandoned because of international complications.

Subsequent to the Siberian project, Dr. Waddell devoted considerable time to a study of the problem and design of a wonderfully unique structure to bridge the neck of the harbor at Havana, Cuba, adjacent to Cabaña Castle. This bridge of 800-foot main span and nearly 200-foot clear height was to have an imposing, spiral-tower, terminal approach for highway vehicles. This design combined a remarkable degree of originality with architectural and artistic beauty. The project was unavoidably postponed on account of the advent of the World War.

During the busy years in which Dr. Waddell was executing these important works he found time to undertake exhaustive investigations into the properties and development of nickel steel and other alloy steels for bridge and structural purposes, and into the life of railroad ties, both subjects of prime importance to bridge engineers and other constructors. He has also made a very thorough investigation of the creeping of railroad rails.

During these last four decades, covering the most important part of Dr. Waddell's professional experience, he has found time to write six technical books, besides the two written in Japan, including De Pontibus (an encyclopedic hand book of modern bridge construction), two volumes of "Bridge Engineering," and, even more important, "Economics of Bridgework." Besides those he has written upwards of 100 technical papers, addresses, monographs of important engineering, mathematical, constructional, ethical, and educational topics that have been published and republished in six of the principal foreign languages.

Beyond these master achievements of his lifetime, Dr. Waddell has paid rich tribute to his Alma Mater, to his profession, to his country, and, indeed, to the world, making unprecedented gifts of labor, time, and money spent in making presentation of his most valuable data to all who cared to profit by them, and lecturing (always gratis) abroad and in almost one-half of the technical schools of North America.

During the World War, when most other engineering offices were, of necessity, closed, and when he and others gave, gave, and gave again, and indeed until it hurt—and then some, Dr. Waddell, far from diminishing

his office staff when work dwindled, maintained it on full time and spent a man-size fortune, accumulated by the successful efforts of a long career, for the employment of an *additional* staff, who arranged, analyzed, and tabulated under his personal supervision the records, data, conclusions, and results of his lifetime of successful designing and his numerous investigations of technical, mathematical, and scientific questions concerned with bridge construction. These, properly used, give authoritative data with which it is not only possible, but comparatively easy, for a well informed general engineer to estimate and check many important and complicated problems that otherwise would require the expenditure of a vast amount of research and money. These results, in his monumental work, "Bridge Engineering," have been placed in the simplest and most convenient verified form, so as to be available to the profession to which he has devoted his life-long energies. Such work is equally an honor to his Alma Mater, an inspiration to his successors, and a monumental tribute to his ability and generous personality.

In 1915 Mr. Harrington withdrew from the firm to start a firm of his own; and Dr. Waddell carried on the practice, part of the time with his son, Everett, now deceased, and part of the time alone until January 1, 1927, when he took on as partner Mr. (now Dr.) Shortridge Hardesty under the firm name of Waddell & Hardesty. Dr. Waddell selected Mr. Hardesty as an assistant in 1908, just before he graduated from the Rensselaer Polytechnic Institute, where he made the grade of Vice-President of Sigma Xi. He has been in the Author's office ever since, having risen therein step by step until finally he became junior partner of the firm, which is now enjoying an exceedingly large and lucrative practice.

It remains only to learn that today Dr. Waddell is Consulting Bridge Engineer of The Port of New York Authority on the design and construction of two bridges, to cost some $16,500,000, that will connect Staten Island with the state of New Jersey, on which the construction is rapidly drawing to a close. He was the designing and supervising engineer of the $3,000,000 bridge across the Kennebec River at Bath, Maine, lately completed; and he has been consulted on several other equally important or greater bridge constructions now pending, including enormous spans for San Francisco Harbor, a $3,000,000 bridge to cross the Mississippi River and a similar one to cross the Ohio River near Cairo, Ill., and has figured privately on structures over the Hudson at New York as well as the contemplated unprecedented single span across the Narrows of New York Harbor, which he has estimated might be constructed, if local conditions are found on investigation to be advantageous, at a cost of about $100,000,000 for a 5000-foot main span with 130-foot roadway, exclusive of approaches.

His technical writings have been recognized and appreciated by *three* awards (a still unequaled number for a single individual) of the Norman Medal, the highest recognition by the American Society of Civil Engi-

neers; membership and honorary membership in a dozen or more of the principal engineering organizations and societies of the United States and Canada; honorary membership in the National Engineering Societies of Spain, Peru, and China; and correspondent of the Academy of Sciences, Paris, France, and of the Royal Academy of Sciences and Arts, Barcelona, Spain. Five orders of Knighthood, most of them of very high rank, have been bestowed on him by the Governments of Japan, Russia, China, and Italy.

Dr. Waddell was a member of the International High Commission of five Engineers, from America, Belgium, England, France, and Japan, that passed on designs submitted in a world-wide competition for the construction of a new bridge over the Yellow River for the Peking-Hankow Railway, China, to cost not less than five or six million dollars. On this mission Dr. Waddell remained about six months in China, performing various other important engineering services for the Chinese Government, and estimating on work to cost about $25,000,000.00, gold.

Recently Dr. Waddell has been retained to estimate on five immense bridge projects involving many million dollars, two of them for extremely long structures on the Pacific Coast, and one for a bridge more than ten miles long on the Atlantic Coast. Two of these have lately materialized, one may soon materialize, but two will probably fall through. He also made a few years ago a private investigation for an assumed 3200-foot suspension span across the Hudson River at 178th Street. He has completed an analysis and formulation of the design of long bridge-spans that provide diagrams for the rapid and accurate determination of their weights and costs up to dimensions hitherto considered impracticable, and has presented the results of this investigation in a Memoir to the American Society of Civil Engineers, entitled "Quantities of Materials and Costs per Square Foot of Floor in Highway and Electric-Railway Long-Span Suspension-Bridges."

Some two years ago his friend, Dr. D. B. Steinman, then President of the American Association of Engineers, persuaded Dr. Waddell, on the plea of its being his duty to the young engineers of this country, to become a member of that Society and take an active part in its labors. He was soon made Chairman of the Committee on Engineering Education; and the report of that Committee, recommending many fundamental changes in technical teaching, has been distributed among the presidents and engineering deans of all the American and Canadian universities, colleges, and schools where engineering is taught, as well as among the officials of the leading technical societies; and, judging by the numerous acknowledgments, it is destined to effect material progress in the teaching of technics.

Dr. Waddell was reappointed Chairman of that Committee to undertake the task of preparing a book on the subject of Vocational Guidance, to be written by some of the leading experts in the principal divisions of engineering, and edited by the Committee.

An enumeration of the principal bridges designed and built by Dr. Waddell in addition to those already mentioned includes highway bridges across the Missouri River at Jefferson City, Lexington, and St. Charles, Missouri; the designing and construction of over 200 bridges on the Vera Cruz & Pacific Railway of Mexico; two lighthouses and numerous standard highway bridges for the Government of Cuba; most of the bridges on the Kansas City Southern Railway, St. Louis Valley Railway, International and Great Northern Railway, Louisiana R. R. and Navigation Company's line, and the Tennessee Central Railway; a large bridge over the Maumee River at Toledo; a reinforced-concrete arch bridge over the Colorado River at Austin, Texas; two reinforced-concrete trestles at Tacoma, Washington; the Granville Street, the Cambie Street, and the Westminster Avenue Bridges over False Creek at Vancouver, B. C.; a large viaduct joining Kansas City, Missouri, and Kansas City, Kansas, and crossing the Kaw River; the Arroyo Seco Concrete-Arch Bridge at Pasadena, California; the Twelfth Street Viaduct at Kansas City, Missouri; the Keithsburg Bridge over the Mississippi River for the Iowa Central Railway Company; the Canadian Northern Pacific Railway Company's nineteen bridges over the Fraser, Thompson, and North Thompson Rivers and their tributaries in British Columbia; the Louisiana & Arkansas Railway Bridges over Black River and Little River in Louisiana; the Salem, Falls City, and Western Railway Bridge over the Willamette River at Salem, Oregon; the Swope Park and Fourth Street Bridges in Kansas City, Missouri, and highway bridges for the cities of Trenton, New Jersey, Cleveland, Ohio, Spokane, Washington, Missoula, Montana, Trail, British Columbia, and Springfield, Massachusetts.

In 1903 he prepared specifications and complete detail designs for a system of standard highway bridges for the Republic of Cuba; and, to meet the greatly changed requirements developed by automobile traffic, he was retained to replace these designs by entirely new and up-to-date ones in 1926.

In 1903 Dr. Waddell was retained by the International Nickel Company of New York City, which company then controlled three-quarters of the world's total output of nickel, to make an extensive investigation of the suitability of nickel steel for bridge building. His experiments included all standard and many special practical tests, and occupied over three years. After the investigation and the reports were finished, he wrote for the American Society of Civil Engineers a long paper describing fully the tests and drawing numerous deductions. This paper, entitled "Nickel Steel for Bridges," was published in the Society's "Transactions" for 1909 and received the distinguished reward of the Norman Medal. The result of his investigations has been the use of nickel steel for several long-span bridges, including the Manhattan Bridge, New York, the Free Bridge, St. Louis, the new Quebec Bridge, and several other important structures.

Dr. Waddell was decorated in 1909 by the Grand Duchess Olga of

Russia (Sister of the Czar), First Class Order Société de Bienfaisance, for services as Principal Engineer of the proposed Trans-Alaska-Siberian Railway.

While making a trip around the world with his wife in 1921, after finishing his work for the Chinese Government, they were received in private audience by both the Prince Regent (now the Emperor) of Japan and his mother, the Empress; and Dr. Waddell was given the Second Class Order of the Sacred Treasure, there being nine classes in that Order, as a recognition of his services in training, during thirty-five years, a large number of young Japanese engineers in his office.

Early in 1922 the Chinese Government conferred on him the Second Class Order of the Sacred Grain for services rendered it in the latter half of 1921, there being nine classes in that Order also.

While traveling through Italy, Dr. Waddell was granted a private audience of a full half-hour by His Majesty, King Victor Emanuel; and soon afterwards the King sent him the Order of the Crown of Italy with the rank of Cavaliere.

Among other scholastic degrees, Dr. Waddell has received a D.Sc. from McGill University, an LL.D. from Missouri State University, a D.E. from Nebraska State University, and Hakushi from the Imperial University of Japan.

One of the Doctor's latest honors was an entirely unexpected election to membership in the Authors' Club of London, a body composed of the élite of modern English writers.

In spite of so many years of constant, arduous service and heavy responsibilities, or perhaps because of them, Dr. Waddell carries lightly the decades that have been filled to overflowing with hard work, notable achievement, and abundant distinction at home and abroad.

Always animated solely by the spirit of worth-while accomplishment and the determination to be satisfied only with the best results, inspired with a boundless devotion to his profession and an almost equal general interest and helpful spirit toward its members, especially the younger ones and the preparatory students, he has never missed an opportunity but has created many, to make and encourage the expansion of technical science and art, the setting of new standards, the development and improvement of existing practice, and the uniformly successful execution of investigations, designs, and constructions of exceptional difficulty or magnitude.

His habits of preliminary investigation, research, thorough analysis, rational treatment, accuracy, careful execution, and indomitable courage, determination, and persistence have insured the many successes; have prevented the failures, accidents, and disappointments that so frequently overtake men of high attainment; and have built up his reputation and inspired the confidence manifested so many times by his countrymen and foreigners by placing important professional commissions in his hands.

An exponent of the broadest and most liberal determinations of professional knowledge and experience, with a profound appreciation of the difficulties and needs of other engineers, and a joyous delight in promoting their interests, he has always given with unbounded liberality and heartily of his time and labor and money to benefit others and to report valuable experiences, observations, and researches in such a way that they can be most readily utilized by others.

A firm believer in the doctrine of circulating help and good fellowship to all and sundry, he has never concealed valuable professional information, considering it rather a trust for his fellows than a personal asset, and has, probably to a much larger extent than any other engineer, at a great outlay of time, labor, and cash, published the salient results attained by his study, research, and experience in a large series of valuable papers and important books that, singly and collectively, are invaluable acquisitions to professional literature.

Although an indefatigable worker at his desk, in conference or otherwise during most of his waking hours, rapidly and conscientiously writing out in long hand his accurate and well-finished papers and discussions in his office or during numerous long railroad trips back and forth across the continent, he still finds time, strength, endurance, and zest for outdoor sports and indoor diversions and entertainments. He is an excellent bridge player, a captivating story teller, an entertaining companion, a charming host, and a loyal friend.

Still in the prime of life, although in his seventy-fifth year, honored and respected by his professional brethren and associates, as well as by distinguished men and high officials in many countries that claim friendship with him, the passing years are filled more and more abundantly with well-earned success and distinction, and he enjoys the harvest of an enviable career of hard work and notable achievement that place him in the front rank of civil engineers who have adorned and benefited their noble profession.

He is a Member of the American Institute of Consulting Engineers; American Society of Civil Engineers; American Association of Engineers; *La Société des Ingénieurs Civils de France;* Engineering Institute of Canada; Franklin Institute; Western Society of Engineers; American Association for the Advancement of Science; American Society for Testing Materials; International Society for Testing Materials; American Railway Engineering Association; Rensselaer Society of Engineers; National Conservation Association; Economic League; *Société International d'Études de Correspondance et des Changes, Concordia, Paris;* Society for the Promotion of Engineering Education; Geographical Society of France, and honorary member of the Institution of Structural Engineers of Great Britain, the Kogaku Kyokai (Japanese Engineering Society), Sigma Xi, Tau Beta Pi, and Phi Beta Kappa.

Dr. Waddell is an outdoor man and an ardent sportsman, expert with

rod and gun, and experienced in the woods and waters of North America, from Vancouver and the Canadian Rockies to Nova Scotia, the Gulf of Mexico and Florida, besides having shot and fished in Japan, Mexico, and Cuba. He is expert with rifle and shot gun and has to his credit some fine deer and elk from Colorado, Arkansas, and Minnesota.

Every year he "rests" strenuously for a few weeks, summer and fall, catching tarpon in the Gulf of Mexico, where it is not unusual for him to have in one day from ten to twenty strikes, and to land almost half as many of the gallant fighters (up to 150 pounders) with a 16-ounce rod and a No. 36 line, invariably, as is customary in that sport, releasing them uninjured after finishing the battle by bringing them alongside the boat. Sometimes a shark appropriates the catch en route to the launch, and then perhaps, effective measures are taken to avenge the unlucky tarpon. Other game fish, too, are occasionally the object of a day's cruise; and when the shooting season opens, Dr. Waddell is usually on hand, off shore or in the bayous, to accumulate his quota of wild ducks that are prized by his friends who are fortunate enough to be within shipping distance.

Dr. Waddell is a fair swimmer, fond of both surf and fresh-water bathing, and indulges that pleasure most conveniently at his summer home in Seabright, N. J., where a few steps from his front door plunge him into mighty Atlantic rollers, and an equal distance in the opposite direction brings him to his own landing on the shore of the placid Shrewsbury River.

He has little time for clubs but retains membership in the Country Club, the University Club, and the Engineers' Club of Kansas City, and in the Railroad Club of New York.