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belated classes, generally of the older men, have their class dinners in town.

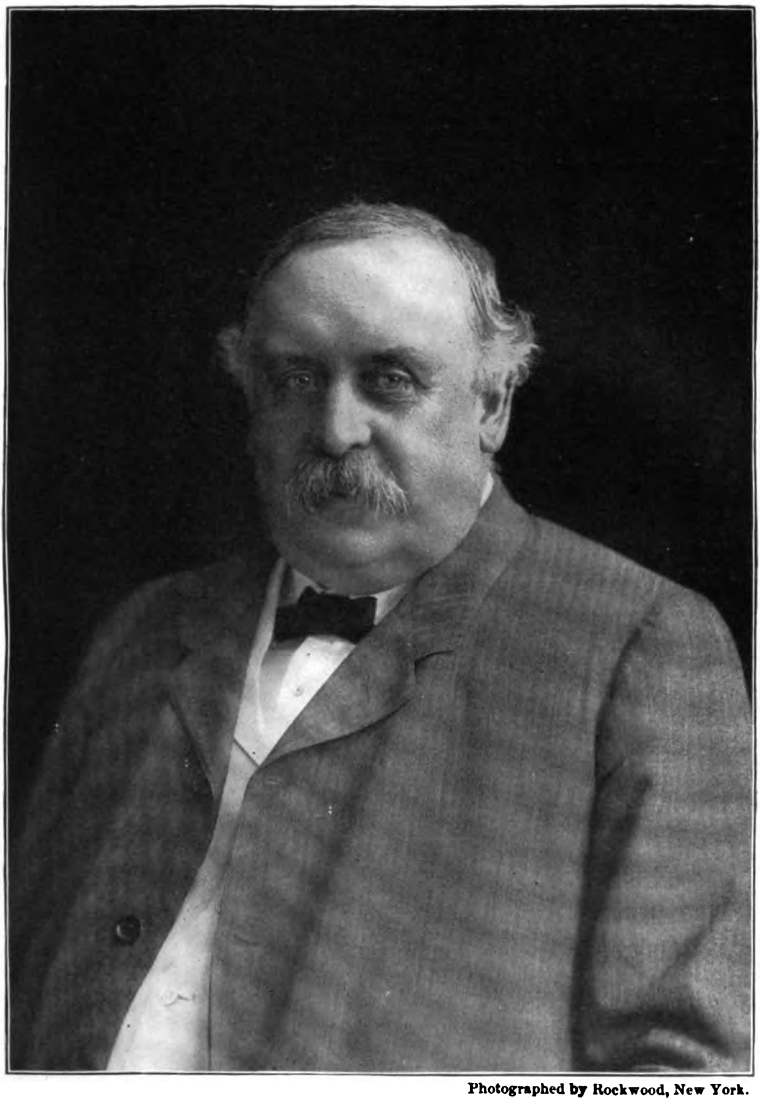
Thursday the Phi Beta Kappa men are on hand for their celebration; while the great majority of the graduates either start for home or take the special trains to the New London races. And so Harvard's annual Old Home Week comes to a close, and any graduate who has participated in it without being moved

> "Is fit for treasons, stratagems, and spoils;
> The motions of his spirit are dull as night,
> And his affections dark as Erebus.
> Let no such man be trusted."

The program which the various class secretaries and committees have thus developed has had one obvious result — Class Spirit, to the death of which so many obituary regrets have been addressed during the past twenty years, has been genuinely stimulated. You can hardly say that Class Spirit is flagging, when '78 makes its fine gift to the Harvard Union, '79 puts up the Stadium, and more recent classes vie with each other in adorning the College; and when '93 has over 200 men at its decennial celebration. We are just at the beginning of the benefits, direct and indirect, which will spring from Harvard's Old Home Week.

GEORGE SHATTUCK MORISON.

George Shattuck Morison died in New York city on July 1. He was born in New Bedford, Mass., Dec. 19, 1842, son of John Hopkins and Emily Rogers Morison. John Morison, the earliest ancestor on the paternal side who came to this country, was born in Aberdeenshire, Scotland, emigrated to America about 1720 and settled at Londonderry, N. H. His grandson Thomas, born in the north of Ireland, in 1710, was one of the original settlers of Peterborough, N. H., and the captain of its militia company; Nathaniel, grandson of Thomas and grandfather of George S. Morison, was also captain of the Peterborough militia company. His home was in Peterborough, but he died in 1819, at Natchez, Miss., where he had gone to introduce water into that city. Mr. Morison's father, born in Peterborough, 1808, graduated at Harvard in 1831, was the minister of the First Parish (Unitarian), in Milton, Mass., for thirty years, and was *pastor emeritus* at the time of his death in 1896. His mother, a native of Charlestown, Mass., was a daughter of Abner Rogers (H. C. 1800), and granddaughter of Joseph Hurd, of Charlestown, Mass.



Photographed by Rockwood, New York.

GEORGE SHATTUCK MORISON.

George S. Morison was fitted for college at Phillips Exeter Academy, was graduated at Harvard in 1863, and at the Harvard Law School three years later, receiving the degree of LL. B. Removing to New York, he was admitted to the bar in 1866, but did not practice. Turning to civil engineering, he began work in October, 1867, on the bridge across the Missouri at Kansas City, under Octave Chanute, chief engineer. He remained in Kansas City until 1871, when he removed to Detroit, Mich., to become chief engineer of the Detroit, Eel River and Illinois R. R. From April, 1873, until November, 1875, he was principal assistant engineer of the Erie R. R. under Mr. Chanute, chief engineer, and during that time rebuilt the celebrated viaduct over the Genesee River at Portage. For ten years (1875–1885) he had close relations with the house of S. C. & G. C. Ward, the American agents for Baring Brothers & Co., and in their interest served as director of the St. Louis Iron Mountain and Southern Ry., the Eastern R. R., the Maine Central R. R., and the Ohio and Mississippi Ry. For five years (1875–1880) he was a member of the firm of Morison, Field & Co., bridge contractors, from which he withdrew, as he could not follow both contracting and engineering work proper.

In 1887 Mr. Morison removed to Chicago, retaining, however, an office in New York, and for two years was in partnership with Elmer L. Corthell. During this period he made a trip round the world. He built, as chief engineer, ten bridges across the Missouri, as follows: Plattsmouth, Neb., 1880; Bismarck, N. D., 1882; Blair Crossing, Neb., 1883; Rulo, Neb., 1887; Omaha, Neb., 1887; Nebraska City, Neb., 1888; Sioux City, Iowa, 1888; Bellefontaine Bluffs, Mo., 1893; Leavenworth, Kan., 1893; Atchison, Kan. (new superstructure), 1901. He also built five bridges across the Mississippi, viz.: Winona, Minn., 1891; Burlington, Iowa (new superstructure), 1891; Alton, Ill., 1893; Merchants' Bridge, St. Louis, Mo. (consulting engineer), 1890; Memphis, Tenn., 1893; and the great bridge across the Ohio at Cairo, Ill. (1889); besides others on less important rivers. The most difficult work was the Memphis Bridge, which has a total length, including the viaduct approaches, of 4,988 feet, a main span of 790.42 feet and two river spans of 621 feet each, with very deep and difficult foundations. But two other bridges in the world have longer truss spans, that over the Forth, in Scotland, and the Lansdowne (Sukkur) Bridge in India.[1]

In addition to bridge construction, Mr. Morison devoted himself to the conditions and earning capacity of different railroad systems, to locating of railroads and to designing yards and terminals. In 1894 Pres. Cleve-

[1] These details, taken from the *Successful American*, Feb., 1903, were evidently furnished by Mr. Morison.

land appointed him a member of a board of engineers to report on the greatest practicable length of span for a bridge across the Hudson at New York. In 1895 he served on a board of consulting engineers to report on matters relating to the Dock Department of New York city. In 1896 he was appointed by Pres. Cleveland on the board for locating a deep-water harbor in Southern California. In 1898 he was appointed by Pres. McKinley a member of the Isthmian Canal Commission to determine the most feasible route for a canal across the American Isthmus. It is said that Mr. Morison's judgment determined the Commission to recommend the Panama instead of the Nicaragua route.

In 1898 he resumed his residence in New York. He delivered the Phi Beta Kappa oration at Harvard in 1896 (published in the *Harvard Graduates' Magazine*, Sept., 1896), stating with much vigor what should be the relation of the University to the new epoch of science and invention. His presidential address before the American Society of Civil Engineers was also a work of marked power. To the transactions of societies and to reviews he contributed many articles, and he delivered many addresses, his most important recently being on the Isthmian Canal. He was a member of the American Society of Civil Engineers, being its president in 1895, of the American Institute of Mining Engineers, of the American Society of Mechanical Engineers, of the Western Society of Engineers (Chicago), of the Institution of Civil Engineers (London), and of the Mexican Society of Engineers and Architects. He was an Associate Fellow of the American Academy of Arts and Sciences and a Fellow of the American Association for the Advancement of Science. He was also a member of the Union, University, Engineers, and Down-town Clubs of New York, of the Union Club of Boston, and the Chicago and Union Clubs of Chicago.

Mr. Morison was a loyal son of Phillips Exeter Academy, and much of his non-professional work was done in its behalf. Elected a trustee in 1888, he served on the board till his death, for the last five years being its president. To his energy was largely due the rejuvenation of the Academy, the raising of its effectiveness in teaching, the addition of buildings, and the increase in its endowment. Mr. Morison gave to it liberally, not only of his time, but of his means; and at the last Commencement at Exeter, which he was too ill to attend, a letter from him was read in which he outlined a large project of benefaction. Mr. Morison never married.

Speaking of his professional eminence, a recent writer says: "The Missouri is one of the most troublesome of all the great rivers of the world. Its swift current, changing channel, and treacherous bottom unite to make it the dread of engineers. In the nine [ten] great bridges which Mr.

Morison has built over that stream unexampled combinations of difficulties came up. In this work, as in all the other bridge work which has been specified above, on streams offering a great variety of physical conditions, Mr. Morison was the actual chief engineer, controlling everything, to the last detail, and he has shown himself to possess that combination of knowledge of the work of others, patience in the study of the details of his own work, fertility of resource, courage, and soundness of judgment, which unite to make the engineer of the first rank." [1]

Of his personality Col. H. G. Prout — Gen. Gordon's assistant and governor of the Provinces of the Equator — who knew Mr. Morison well, writes: —

"Strange as it may sound to those who saw him but superficially, he was a very shy man. He was sensitive, diffident, and most reticent about himself. His Scotch blood and his New England breeding were perhaps the sources of that instinctive reluctance to take any one into his confidence, which had become intensified in the life of a bachelor and without frequent intercourse with his own close kin. More, perhaps, than any other man of my acquaintance he stood alone, intellectually and in sentiment. He did his own thinking and he directed his own conduct. He was a powerful man in intelligence and in will. I have often said that he was the most intellectual man of my acquaintance. But he was an interesting example of the occasional insufficiency of mere intellectual power. His fierce prejudice and his want of sympathy sometimes injured his judgment even in professional matters. I cannot take space to develop this, but those who are familiar with his work will supply examples. Yet he was a great engineer — a born engineer, who could not be diverted or kept down by education. And he was a man of great reading, observation, and meditation. The range of his interest was universal, and he looked at the universe from a lofty standpoint and with a truly philosophical spirit. . . . There was one side of his life of which his nearest friends knew little, and that little they usually knew only by accident. He used his abundant means to help others, liberally but judiciously and in his own way. He was interested in education and helped boys through college, but the boys had to be worth helping." [1]

The breadth of Mr. Morison's reputation was shown in the notices which the leading Paris newspapers published at his death. The *Matin*, *Temps*, and *Figaro* credited him with having convinced the United States government that the Panama route should be adopted. The *Matin* referred to the flattering recognition he received from the Exposition of 1900 for his Memphis Bridge, and declared that the part he played as Canal Commissioner was historical.

In collaboration with his brother, Robert S. Morison, '69, and his sister, Mr. Morison prepared a life of their father, John Hopkins Morison, '31, which was printed in 1897.

[1] *The Railroad Gazette*, New York, July 10, 1903.

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GEORGE S. MORISON.

EMIL GERBER, S. B.

On July 1st last the engineering profession in particular and the world at large in general lost one of its shining lights in the death of Mr. George S. Morison, of New York.

The newspapers and engineering journals of the time have given so full an account of his professional life that the merest outline of it will suffice here. He was born December 19th, 1842, at New Bedford, Mass., of a Scotch-Irish-American family that settled in New Hampshire in 1720. He graduated from Harvard in 1863 and from its law school in 1866, and was for a year in a law office in New York, having been admitted to the New York bar.

Engineering being more to his liking, he accepted a position on the construction of the Kansas City Bridge over the Missouri in 1867. In 1871 he became Chief Engineer of the Detroit, Eel River & Illinois R. R. and in 1873 Principal Assistant Engineer of the Erie R. R. In 1875 he became regularly connected with the American agents of Baring Brothers of London and was engaged largely in consulting work on railroad properties for about ten years. During this time he was also a member of the firm of Morison, Field & Co., bridge building contractors, but withdrew from this firm to engage exclusively in profes-

sional work. From 1880 to 1895 he constructed as Chief Engineer ten bridges over the Missouri, five over the Mississippi, one over the Ohio at Cairo, one over the St. John's at Jacksonville, Florida, one over the Willamette at Portland, Oregon, besides a great many smaller ones in every part of the United States.

He served on the following commissions, appointed by the President of the United States; to report on the greatest practicable length of span for a bridge across the Hudson at New York; on Deepwater Harbor in Southern California, and on the Isthmian Canal. He was awarded prizes by the Government in two of the competitions for prominent bridges near Washington.

He also served on several commissions on New York City engineering works and made several examinations of water power developments.

His greatest completed work is the bridge across the Mississippi River at Memphis, Tenn. It has the longest trussed span of any bridge in the United States and is exceeded by only two others in the world. Such a long span was necessitated by the extreme difficulties of the foundations.

Such is briefly his more important work. That such work required a master mind goes without saying, and when it is considered that Mr. Morison had no special technical training in engineering, but entered the field when he was nearly 25 years old, it is indeed marvelous. Nature endowed him with a strong intellect and a strong will and he made the most of it. The whole grand success may be summed up in the word "work." He had no influential friends to help him whom he did not make himself by his indomitable energy and proven ability. He studied his work carefully and thoroughly, and the minutest detail

was not too small to be worked out with the greatest consideration before it was executed. One of his rules was that if he had five minutes in which to do a thing he would take three, if necessary, to think it out, and do it in the other two.

In his work he was original and not merely an imitator or developer of existing ideas. He sought to make the best possible solution of a problem and not necessarily a solution which had been shown to be a success under similar circumstances. He sought and had a reason for everything and had the courage to act according to his reason. He did not, however, carry his originality to extremes. Every previous example bearing on a case was carefully studied, and if he found that some existing idea suited his purpose better than any other he did not hesitate to make use of it and properly gave credit where it was due.

Nor did he fail to consider the commercial practicability of his designs. His work was, no doubt, of the very highest order of his time, but he did not make it of such extreme character that it could not be practically attained. It was always a little better than had been done before but never out of reach, and thus he led in the development of bridge-building, the better standards of to-day being about up to his requirements of a decade ago.

While Mr. Morison always studied out and knew every detail about his work himself, he was careful to surround himself with a competent, faithful and conscientious staff. An indefatigable seeker after truth and the best obtainable himself, he expected his staff to be no less energetic, accurate and conscientious in their work than he, and an indolent or slovenly worker did not remain long in his service.

Mr. Morison was a great traveler, his work calling him to all parts of the United States, the Isthmus and to Europe.

His business travels were supplemented by a trip around the world as well as smaller ones to our southern neighbors. He was an accurate and minute observer, and this together with his studious habits and early education gave him a wonderful and very extended fund of knowledge, which made him an entertaining conversationalist and a scholarly, concise writer.

He is the only engineer ever asked to deliver the Phi Betta Kappa oration at Harvard, which he did in 1896 with marked success. The substance of this address, with several others bearing on the same subject, is shortly to be published under the title of "The New Epoch as Developed in the Manufacture of Power."

He was for ten years a trustee of the Philips Exeter Academy and five years President of the Board. To testify to his belief, as a man of science, in the value of classical study he endowed the Morison Professorship of Latin there.

He was President of the American Society of Civil Engineers in 1895, and was an honored member of nearly all the National Engineering Societies of America as well as of some foreign bodies. To nearly all of these he made valuable literary contributions, and perhaps his most noteworthy literary work in the last year has been a series of three lectures on the Panama Canal, which have probably done more to influence the public mind in favor of the Panama location than anything else.

With all his varied interests he found time to do for others in a quiet way, by suggestions, advice, and financial aid, if the case warranted it.

Notwithstanding the vast amount of work he had accomplished, there was a greater future before him, and we may well mourn the loss of a man so useful to the whole world as was Mr. Morison.

THE

Engineering Record

BUILDING RECORD AND SANITARY ENGINEER

VOLUME XLVIII

July—December, 1903

McGraw Publishing Co.
114 Liberty Street
New York

George Shattuck Morison.

By the death of George S. Morison on July 1 the engineering profession has lost one of its most able and successful members. Along with engineering attainments of the highest order, he possessed a knowledge of the law and a grasp of financial subjects that rendered his advice of exceptional value. While not a popular man among engineers, owing to his aggressive personality, he had the respect of practically everybody on account of his independence and great ability; and his wonderfully active mind and conversational gifts won for him among prominent men of affairs a large circle of strong business friends.

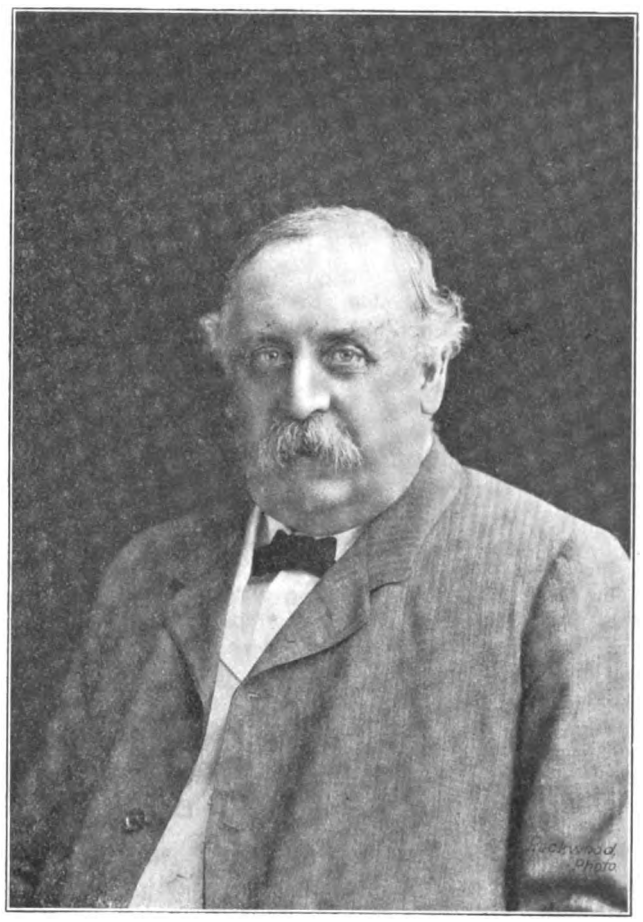
He was born in New Bedford, Mass., on December 19, 1842, of a Scotch-American family that settled in the American colonies about 1720. For a number of generations the family homestead has been at Peterborough, N. H., and here Mr. Morison built a large country residence about eight years ago from plans prepared under his own direction. It was a characteristic trait which led him to plan this house personally. A number of notable structures erected by prominent architects a short time before were not at all pleasing to his taste, and he published the fact somewhat widely. This criticism was resented just as publicly, and largely to show that he was competent to pass such a judgment he planned and built this house. It must not be inferred, however, that he was not fully aware of the value of architectural studies, for he often referred to the assistance derived by his association with Mr. Edward P. Casey on some of his masonry bridges.

Mr. Morison was not educated as an engineer. His father was an eminent Unitarian clergyman, and his sons were early destined for the so-called learned professions. George S. Morison decided upon the bar, and with this object in view attended Philips Exeter Academy and Harvard University, from which he was graduated with the LL.B. degree in 1863. He studied later in the office of Joseph H. Choate and was admitted to the New York bar, but never practiced. Engineering was inevitably his chosen profession, and in 1867 he adopted it definitely. It is an interesting fact that he was almost 25 years of age when he took this step.

Once engaged in this work he advanced with remarkable rapidity. For the first four years he was engaged under Mr. Octave Chanute, mainly on bridge construction at Kansas City. Then for two years he was chief engineer of the Detroit, Eel River and Illinois Railroad, where he showed a grasp of railway problems that led to his selection as principal assistant engineer of the Erie Railway under Mr. Chanute. During this time he was in charge of the construction of the famous Portage Viaduct over the Genesee River. By 1875 his eminent financial ability had been demonstrated, and in that year he became closely associated with Messrs. S. C. & G. C. Ward, the American representatives of Baring Brothers, of London. In this capacity he served as director of several railways and was otherwise identified with administrative as well as engineering features of railway affairs. He severed this connection in 1875, however, to become a member of the bridge building firm of Morison, Field & Company, with which he remained until 1880, when he retired in order to practice as consulting engineer exclusively. In this practice he was eminently successful, as the following list of his most notable bridges, some of them planned during a two-year partnership with Mr. E. L. Corthell, will indicate:

Plattsmouth, Neb., 1880; Bismarck, N. Dak., 1882; Blair Crossing, Neb., 1883; Rule, Neb., 1887; Omaha, Neb., 1887; Nebraska City, Neb., 1888; Sioux City, Ia., 1888; Cairo, Ill., 1889; Merchants Bridge, St. Louis, 1890, for which he was consulting engineer; Winona, Minn., 1891; Burlington, Ia., 1891; Alton, Ill., 1893; Bellefontaine Bluffs, Mo., 1893; Leavenworth, Kan., 1893; Memphis, Tenn., 1893; Atchison, Kan., 1901.

His consulting practice was by no means confined to such large bridges, however, for he designed many smaller structures, and was often retained to report on railway properties and to assist in the planning of important yards and terminals. Of late years he gave a large part of his time to the work of the Isthmian Canal



Geo. S. Morison.

Commission, of which he was a member, and it was generally understood that when the work at Panama was undertaken by the United States, Mr. Morison was to be closely identified with it. He was also understood to be certain of selection as engineer of the Detroit bridge, and just after his death the government announced his selection as engineer of an important masonry bridge in Washington.

Mr. Morison was a member of the national civil, mechanical and mining engineering societies, the Institution of Civil Engineers, the Western Society of Engineers, the Mexican Society of Engineers and Architects and numerous scientific and social organizations. He was president of the American Society of Civil Engineers in 1895, and it was under his administration that the publication of monthly "Proceedings" was begun and the "Transactions" were put in their present form. The most important work of his presidency was, however, the beginning of the present house of the Society. It is worth noting that although he was living in Chicago at the time, Mr. Morison rarely, if ever, failed to preside at the semi-monthly meetings. He contributed several important papers to the Society's "Transactions," and discussed many others with the knowledge that comes from ripe experience, careful observation and close study, so that his statements were always of unusual value. One reason for their influence was doubtless their scholarly, incisive style, which found its best expression in his account of the history and purpose of engineering, in both his presidential address before the American Society of Civil Engineers and his Phi Beta Kappa oration at Harvard in 1896.

Mr. Morison's last illness began about six weeks ago, on his return from Porto Rico. He was attacked by intermittent fever, but it was not considered serious and he prepared to visit his Peterborough home. Kidney troubles developed, however, and he rapidly grew worse, dying on the evening preceding the day set for an operation.

Just what position Mr. Morison will hold in the history of the engineering profession cannot be stated now. His bridges unquestionably represent the best practice of the time when they were built. In other branches of engineering, his preferences have not been so well received. His work on the American Society of Civil Engineers' committee on standard rail sections was not in accord with that of the other members, and his differences of opinion with his associates on the Isthmian Canal Commission with respect to Panama Canal subjects are too recent to need comment. Everything he did, however, he had strong arguments to support, and more than once he was in the position of an obstinate twelfth juror who finally forces his eleven associates to abandon their earliest opinions. Possibly one reason for his occasional lack of supporters was the way in which he drove his views ahead, with little regard to the feelings of others. This was an impersonal manner, however, not directed against his opponents so much as their views. When business affairs permitted, he was always ready to place his knowledge at the service of young engineers, and The Engineering Record has often heard of his work of this nature, always performed gratuitously. His was an intensely individual personality, marked by great abilities and marred by a few eccentricities which those who knew him best readily overlooked. Unfortunately the eccentricities are always more noticeable than the sterling qualities, and it is probably doubly true in Mr. Morison's case.

The following comment from a gentleman long associated with Mr. Morison affords a glimpse of a side of his character that few had an opportunity of becoming acquainted with: "I think I am safe in saying that most of the people who were connected with him any length of time learned to respect and admire him for his great engineering ability, his broad general knowledge, his accurate judgment on most matters, and his absolute integrity and fairness towards all with whom he had dealings. His actions were regulated not so much by conventional usage as by what after mature thought he considered right. He had a reason for every act and the courage to act according to his reason. The kinder side of his nature was probably not so well known to people who came

in contact with him in a business way only. That he had a large measure of this I was in a peculiar position for many years to know, and take pleasure in saying that to me this side of his character far outweighed any peculiarities which he may have had, and am sure that most former members of his staff entertain the same feelings."

Book Notes.

The manufacture and use of briquette fuels have been investigated by the consular service and the reports from many countries have just appeared in a well illustrated pamphlet. While some of the technical statements are calculated to provoke a smile, the general value of the compilation is considerable to anyone who wishes to learn about the extensive use of briquettes abroad. The title of the pamphlet is "Briquettes as Fuel," and it is profusely illustrated. (Washington, Bureau of Foreign Commerce; 9x6 inches, 156 pp.).

Among the 61 papers in "Contributions to Economic Geology" for 1902, published by the U. S. Geological Survey, the following relate to subjects within the field of this journal: Origin and Distribution of Asphalt and Bituminous Rock Deposits in the United States, by George H. Eldridge; Asphalt Deposits of Pike County, Ark., by C. W. Hayes; the Stone Industry Near Chicago, by W. C. Alden; the Slate Industry at Slatington, Pa., and Martinsburg, W. Va., by T. N. Dale; Tennessee Marbles, by Arthur Keith; Cement Investigations in Arizona, by Edward Duryee. (Washington, U. S. Geological Survey; 9x6 inches, 450 pp.).

Water-power development in Maine has attracted so much attention that the data concerning the streams of this state are unusually complete and valuable. These data have been compiled by Mr. H. A. Pressey, together with the results of investigations made under the direction of Mr. F. H. Newell, of the U. S. Geological Survey, and are published under the title of "Water Powers of the State of Maine" in the series of water supply and irrigation papers of the Survey. Tables of the discharges of many rivers at various points are given, together with maps of the watersheds and illustrations of developed and undeveloped powers. (Washington, U. S. Geological Survey, 9x6 inches, 124 pp.).

The Principal Species of Wood. By Charles Henry Snow, Dean of the School of Applied Science, New York University. New York: John Wiley & Sons, 203 pages, illustrated. Price, $3.50.

The book is a collection of notes, stated in untechnical language, giving concisely the chief characteristics of the common useful woods of the northern hemisphere, and particularly of North America. The botanical as well as the common names are given at the head of a page, and the other information below in convenient note form under the following heads: Nomenclature; Locality; Features of Tree; Color, Appearance, Grain of Wood; Structural Qualities of Wood; Representative Uses of Wood; Weight of Seasoned Wood; Modulus of Elasticity; Modulus of Rupture; Remarks. The moduli given are those established by the United States Division of Forestry. For each of the most important kinds of trees there is a full page plate showing a view of a typical tree, a large scale view of a portion of the bark, the foliage and fruit, and the grain of the wood. There are thirty-five plates of this character. The book contains a bibliography and convenient index, as well as a table of contents. The illustrations are mostly original and are good. The text contains but little new information; but the kind of knowledge which is commonly desired concerning commercial woods and the trees from which they are obtained is collected from sources sometimes not readily accessible and condensed into convenient shape.

The Thermo Dynamics of Heat Engines. Sidney A. Reeve. 358 5x7½ pages. Cloth, $2.60. The Macmillan Company, New York.

This book is divided into two parts, the first relating to the theory of the subject treated and the second to the application of theory to practice. The theoretical part covers the general principles of energetics, the cycle, the thermal properties of matter, steam, gas and hot air engine cycles, the laws of permanent gases and refrigerating machines. When an author devotes a considerable part of a book of moderate size to the laws of physics, thermo-dynamics or "energetics" as it is called in this instance, the laws are so few in number and can be so briefly stated that the only opportunity one has of bringing out something valuable is in the choice of language used to define those laws, the method of explaining them and their application to every day occurrences to illustrate their significance. Professor Reeve does this very happily in his work and his language is so clear and the points so frequently illustrated by examples that no one reading carefully should have any difficulty in obtaining a thorough grounding in the subject covered, unless it be in the matter of "entropy" to which the author devotes considerable space. No matter how well this subject is handled, some readers will still fail to penetrate the haze that surrounds this "function" or "ratio" or "——rot" as it has been called by different persons.

The practical part of the work gives some general information regarding steam engines in condensed form. In speaking of the different types reference is made to their relative advantages as regards steam distribution, efficiency, capacity per unit of weight, clearance, regulation, complexity and cost. To show how to proportion an engine cylinder for a given work the author gives the method of constructing a theoretical indicator diagram based upon assumed data and from this the mean effective pressure is obtained. Cylinder condensation, jacketing, superheating, etc., are discussed and the application of the entropy temperature diagram to a steam engine is given to show the effect of the phenomena occurring throughout the cycle. A method of proportioning cylinders for compound engines is also given.

Elementary Applied Mechanics. By T. Alexander, professor of engineering, Trinity College, Dublin, and A. W. Thomson, professor of engineering, College of Science, Poona. New York: The Macmillan Company. 575 pages, illustrated. Price, $5.25 net.

Professors Alexander and Thomson have presented a valuable addition to the works on Applied Mechanics, or, perhaps what should be more accurately called the Mechanics of Engineering. This book is a second edition in which the two volumes of the first edition are combined with some important additional matter. Not only have the authors presented in great detail the many principles of mechanics relating to stress and strain, but they have also applied these principles to the design of structures of various kinds, such as beams, trusses, retaining walls, arches, etc. These applications are illustrated by the solutions of many examples. Several chapters are reproductions and extensions of papers by the authors, among which may be mentioned the chapters on The Scientific Design of Masonry Retaining Walls and of their Foundations, the Rules for Maxima Bending Moments under Movable Loads, the Uses of the Polariscope in the Practical Determination of Internal Stress and Strain. There are few works in which the subject of moments and shears under various loadings are so carefully and minutely presented as in this; especially is this true of bending moments under movable wheel loads. To the teacher and student of mechanics this is a valuable work.

The Improvement of Rivers. By B. F. Thomas and D. A. Watt, U. S. Assistant Engineers, members Am. Soc. C. E. New York: John Wiley & Sons. 370 pages, 9x11½ inches, profusely illustrated. Price, $6 net.

Mr. Thomas is already well known to the engineering profession, through his connection with the highly successful improvement of the Big Sandy River, Ky., by means of locks and movable dams, and particularly through his paper on "Movable Dams," presented to the American Society of Civil Engineers, in 1898, and awarded the Norman gold medal. In much of his more recent work he has had the assistance and collaboration of Mr. Watt. In so far as the book relates to the improvement of rivers by slack water methods, particularly as effected by movable dams, it is full and complete, and leaves but little or no room for unfavorable criticism. In its treatment of some of the other means of river improvement, however, the book deals with some of the methods in a general way, and not always with sufficient detail for actual construction or design.

A comprehensive knowledge of the characteristics of rivers is usually essential to the preliminary study of any scheme of improvement; consequently, it appears that a compilation of the actual available data concerning the constants in the usual hydraulic formulas, rainfall, run-off, maximum and minimum flow, would have added to the value of the chapter devoted to this subject. The chapters on the removal of bars, and other obstructions, describes at length, and illustrates fully the most modern and successful appliance for this class of work. The chapters on "Regularization," and on "Dikes and Their Effects," do not show as clearly as some might wish the application of the theory of the flow of water in open channels to the design of works of this class; or the limits of depth, width, slope and velocity desirable, or attainable by this means, or the general practice in locating and spacing the necessary works.

The levee and storage reservoir questions are well presented by bringing together the best available information and opinions and illustrating the present practice. The description of the latest project for the improvement of the southwest pass, at the mouth of the Mississippi River, in the chapter on "River Outlets," shows that the maintenance of such outlet channels, by contracting the width and thus increasing the scouring action of the water, is no longer considered good practice, for in the case mentioned the Board of Army Engineers recommended jetties solely for the protection of the channel, and propose to secure and maintain the requisite depth by the use of powerful dredges. Part three, which constitutes much the larger portion of the book, relates to "Canalization," and its various chapters give in considerable detail the theory and practice followed in creating slackwater improvements, and in the design and construction of locks, lock gates and valves, fixed and movable dams, and affords a compendium of high practical and theoretical value that will be welcomed by all connected with the design or construction of works of this description. The "A" frame movable dam, adopted by the United States Government for