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A Select Annotated Bibliography Applicable to the Study of the Royal Engineers' Building Technology in Nineteenth Century British North America

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This bibliography was prepared in conjunction with a study of 19th-century military construction in Canada. The works included date mainly from the 19th century, as one purpose of this bibliography is to show what works would have been available to the military engineer of the period. In the preparation of this bibliography collections were examined in the Parks Canada Library, the Department of Indian and Northern Affairs Library, the Public Archives Library, the National Library of Canada, the National Research Council Building Research Division Library, the Department of National Defence Library, the Cambridge Military Library in Halifax, N.S., the British Library and the Royal Engineers Library, Chatham, England.

The bibliography is divided into four sections: 1. Encyclopedias; 2. General Works on Architecture; 3. Works on Particular Aspects of Building; 4. Military Writings (mainly books written specifically for military engineers). An appendix contains extracts from "A List of Books of Reference on Professional and Scientific Subjects" prepared by Lt. Col. A.C. Cooke, RE, and printed in the Professional Papers of the Corps of Royal Engineers, New Series, Vol. 15.

1. ENCYCLOPEDIAS

Encyclopedia Britannica. 1st ed. Edinburgh: A. Bell and C. MacFarquar, 1771. 3 vols. [DINA Library]

This provides lengthy articles on subjects such as architecture, fortification and glass, which show the state of technical knowledge of the late 18th century.

As this encyclopedia has appeared in numerous editions, with the entries rewritten, updated and expanded, it is possible by comparing various editions on any subject to see changes in technology and advances in knowledge. In addition to the first edition DINA Library has the ninth (1875-89), the tenth (1902-03) and the eleventh (1910) editions.

Guy, Joseph

The Pocket Cyclopedia, or Epitome of Universal Knowledge: Designed for Senior Scholars in Schools and for Young Persons in General, Containing Multifarious and Useful Information on Numerous Subjects Necessary to be Known by all Persons, yet not to be Found in Books of General Use in Schools. 1st American edition from the "Ninth London Edition, Enlarged and Extensively Improved." Brookfield, Mass.: E. & G. Merriam, 1831. [Parks Canada Library]

According to the preface of this work, "It is presumed ... that this manual will supply many of the purposes of a Dictionary of Arts and Sciences." The section dealing with "Articles of Commerce" contains information on colours and paints, plumbing, glass, brick and stone, though the entries do not contain much detail.

Knight, Charles
Cyclopedia of the Industry of all Nations. London: Charles Knight, 1851. [Parks Canada Library]

Among the topics dealt with in this work are glass, painting and items of building hardware such as locks and nails. Brief descriptions of some manufacturing techniques are included. This work was primarily designed to be of use to visitors to the Great Exhibition of 1851, to aid them in an intelligent appreciation of the exhibits.

Rees, Abraham
The Cyclopaedia or Universal Dictionary of Arts, Sciences and Literature. 39 vols. London: Longman, Hurst, Rees, Orme and Brown, 1819. [DINA Library]

This work contains lengthy articles on such building materials as glass and cement which include considerable historical background as well as detailed information on current manufacturing processes and construction technology.

2. GENERAL WORKS ON ARCHITECTURE AND BUILDING

During the 19th century many books of designs for houses and public buildings were produced. A sampling of British books of this type is included in this bibliography. While these pattern books were often concerned largely with matters of style and ornamentation, on the more practical side are the price lists detailing all the types of work involved in constructing a house or other building. These give some information about how the work was done, how it was measured and what sort of information would have been available to someone drawing up an estimate for construction work. Henry-Russell Hitchcock's American Architectural Books (Minneapolis: University of Minnesota Press, 1962), which covers the whole range of architectural works published in the United States before 1891, contains a very complete listing of American books of house designs. The works of Asher Benjamin (1773-1845) and A.J. Downing (1815-1852) were particularly influential on the design of houses in the United States and went into numerous editions. Hitchcock's book has recently been used as a table of contents for a multi-reel microfilm edition of the works listed. [American Architectural Books. Based on the Henry-Russell Hitchcock Bibliography.... New Haven, Conn.: Research Publications Inc., 1972. 128 reels, 35 mm microfilm. DINA Library]

Boxer, F.N.
The Architects and Artisans' Payment Price Book ... and Practical Hints to Persons about to Build. Montreal: Lovell Printing and Publishing Co., 1876. [Parks Canada Library]

This work gives price lists for every type of work connected with building. It also includes other useful information such as recipes for paints and sample contracts. It is particularly interesting as being a Canadian example of this type of book.

Brooks, S.H.
Designs for Cottage and Villa Architecture. London: Thomas Kelly, [1839]. [DINA Library]

The plates in this volume show details of items such as doors, windows, moldings, chimney pieces, brick work and ventilators, as well as plans for various houses.

Brown, Richard
Domestic Architecture Containing a History of the Science and the Principles of Designing Public Edifices, Private Dwelling Houses.... London: George Virtue, [1842]. [DINA Library]

Much of the author's concern is for choosing the correct siting of buildings, particularly country residences, and the suiting of the style of the home to its surroundings. He discusses among other things chimney flues and shafts, and forms and coverings of roofs. The details given in the plates are artistic rather than structural.

The Builder's Magazine, or, a Universal Dictionary for Architects, Carpenters, Masons, Bricklayers ... Consisting of Designs in Architecture ... Together with the Plans and Sections, Serving as an Unerring Assistant in the Construction of any Building ... by a Society of Architects. London: Printed for E. Newbery, 1800. [National Library, on microfilm; also available on microfilm a 1774 edition]

This book includes price lists for various types of work involved in construction and a dictionary of architectural and building terms.

The Builder's Practical Director. Leipzig and Dresden: A.H. Payne, n.d. [RE Library, Chatham]

This mid-19th-century work contains a considerable amount of technical material on construction practices of the period. It is particularly useful for the information it gives on mortars and on paints.

The Builder's Price-book Containing a Correct List of the Prices Allowed by the most Eminent Surveyors in London to the Several Artificers Concerned in Building. Collected by an Experienced Surveyor. London: Printed for I. Taylor. [National Library has on microfilm 1774, 1788, 1792, 1793, 1795 and 1798 editions of this work, which was apparently up-dated fairly regularly.]

This and the Builder's Magazine were prepared for the use of builders of the day. The price lists give some indication of how the work was to be done, for instance in differentiation of prices for various types of doors.

Burnell, George R., ed.

The Annual Retrospect of Engineering and Architecture. London: Lockwood & Co., Vol. 1, Jan. to Dec. 1861. [British Library]

Only one volume of this work appears to have been published. In his comments on barrack construction and the building of permanent camps for the army, the author of the article on military works criticized the builders for their lack of understanding of the problems of drainage and water supply. He considered that "The Royal Engineers are not sufficiently instructed in the professions either of architecture or civil engineering."

Davy, Christopher

The Architect, Engineer and Operative Builder's Constructive Manual ... Part 1 [the only one issued]. London: John Williams, 1839. [British Library]

Considering it most important for the architect or builder to study geology the author begins his work with a geological survey of England and Wales. Included as well are sections dealing with pile driving, béton, limestone and mortar. There is a discussion of earlier works on limes and cements, the currently accepted practice in using these materials and the use of concrete for foundations.

Dempsey, G. Drysdale

The Builder's Guide: a Practical Manual for the Use of Builders, Clerks of Works, Professional Students, and Others, Engaged in Designing or Superintending the Construction of Buildings, Comprising a Concise and Arranged Description of Materials and Details of Parts, with Rules and Data for Calculating Strengths, and Determining Scantlings and Dimensions; Also Tables of Weights, Lists of Prices, etc. etc. London: Atchley, 1851. [Parks Canada Library]

The title pretty well says it all. Included are sections on mortar and cements, on roof coverings and on fire proofing. As well as practical information Dempsey gives some historical background on the development and change in usage of some building materials.

Fairbairn, William
Useful Information for Engineers. London: Longman, Brown, Green and Longmans, 1856. [British Library]
This is a series of lectures to working engineers and gives an idea of the sort of instruction considered important for those already engaged in the profession.

Gwilt, Joseph
An Encyclopedia of Architcture, Historical, Theoretical and Practical. London: Longman, Green, 1903. [Parks Canada Library; National Library has 1854 and 1867 editions.]
Originally printed in 1842 this work was revised several times. In the Professional Papers of the Corps of Royal Engineers it was recommended as a most valuable work of reference (see Appendix) and would presumably have been used by any engineers who had access to it. It contains extensive chapters on building materials, and the use of various materials, as well as much technical detail, information about changes in technology, a history of architecture, a list of publications relating to architecture, and a glossary.

Gwilt, Joseph
Rudiments of Architecture, Practical and Theoretical. London: Priestly and Weale, 1826. [National Library]
This work begins with a discussion of building materials: different types of timber, stone, brick and tile, slate, lime and cement, glass, and metals. In the second part the author deals with subjects such as foundations, stone walls, brick walls, floors, roofs and arches. He then goes on to a "View of Ancient Architecture" and ends with a dictionary of technical terms.

Kerr, Robert
The Gentleman's House or How to Plan English Residences. Introduction by J. Mordaunt Cook. New York/London: Johnson Reprint Corporation, 1972 (reprint of 1871 edition, 1st edition 1864). [Parks Canada Library]
This work begins with a history of domestic architecture in England, including comments on 19th century architecture. There is a good section on kitchens included in the portion dealing with the planning of various rooms of the house. Kerr also discusses how to estimate the cost of a building.

Law, Henry
Civil Engineering for Practical Engineers, and for the Army and Navy. 5th ed. London: Strahan, 1869. [Parks Canada Library]
This work was No. 13 in Weale's Rudimentary Series and was originally published in sections. Topics dealt with include railways, bridges, canals and docks, with sections on materials employed in construction and on the manufacture of iron. It was a good basic text for a civil engineer.

Loudon, John Claudius
An Encyclopedia of Cottage, Farm and Villa Architecture and Furniture Containing Numerous Designs for Dwellings from the Villa to the Cottage. London: Longman, Brown, Green and Longmans, 1846. [DINA Library]
This was perhaps the most widely known and used book of architectural designs and was republished many times. Loudon included designs for many different styles

and sizes of buildings, with drawings illustrating many technical details of construction, as well as styles of architecture, ornamentation and furniture. Topics such as water supply, framing, window and door mouldings, hardware and staircases are covered.

Nicholson, Peter

The New Practical Builder and Workman's Companion Containing a Full Display and Elucidation of the most Recent and Skilful Methods Pursued by Architects and Artificers in the Various Departments of Carpentry...A Summary of the Art of Building; Copious Accounts of Building Materials...an Extensive Glossary of the Technical Terms. London: Thomas Kelly, 1823. 2 vols. (second volume contains the plates). [Parks Canada Library]

Nicholson includes in this work sections on plastering, plumbing, painting and glazing. There are notes on the composition of cements and mortars, an explanation of terms used in bricklaying and plastering, and comparisons of various types of roof coverings.

Nicholson devoted much of his attention to the improvement of the mechanical processes in building. He was the first author to deal with the methods for forming the joints and the hinging and hanging of doors and shutters. His various works, which included The Carpenter and Joiner's Assistant, Practical Carpentry and A Dictionary of the Science and Practice of Architecture, went into numerous editions, both in Britain and in the United States, and had a wide impact on construction methods.

Notes on Building Construction Arranged to Meet the Requirements of the Syllabus of the Science and Art Department of the Committee of the Council on Education, South Kensington. Part III, Materials. London: Rivingtons, 1889. [Parks Canada Library].

The preface informs us that these notes "deal with the nature, characteristics, qualities and defects of the materials used in Building and Engineering works, and they describe the methods of examining and testing such materials." There is a very substantial chapter on limes, mortars, concrete, plasters and asphalts. There is also a section on paints and varnishes, giving the proportions of the ingredients, a small chapter on glass and one on nails and screws.

Parker, John

The Useful Arts Employed in the Construction of Dwelling Houses. London: John Parker, 1851. [NRC, Building Research Division Library]

The author states that his aim is to "describe the principal arts concerned in building a modern English house of moderate rank." He deals with stone, bricks, bricklaying, mortar, roofing, wood work, windows (including the manufacture of crown and plate glass and glazing), the interior, plastering and paper hanging, fire proofing and hardware.

Partington, C.F.

The Builder's Complete Guide. London: Sherwood, Gilbert and Piper, 1825. [DINA Library]

This is part of a larger work entitled The Mechanics Gallery of Science and Art. It includes an historical sketch of architecture, a glossary of architectural terms, and sections on bricklaying and brickmaking, masonry, carpentry and house-painting. The section on brick includes a lengthy discussion of mortars and cements and some comments on roofing. The section on painting contains recipes for the various colours in common use. One of the illustrations shows a glazier's machine.

Plumer, Peter W.

The Carpenter's and Builder's Guide, Being a Handbook for Workmen, Also a Manual

of Reference for Contractors, Builders etc. Portland, Me.: Hoyt, Fogg & Breed, 1869. [Parks Canada Library]

This is a fairly short work, but with some helpful information such as useful facts for estimates, a glossary of terms, proportions for mortar and plaster, and the sizes of screws most used.

Rankine, William John MacQuorn

A Manual of Civil Engineering. 9th ed., thoroughly revised by E.F. Bamber. London: Charles Griffen and Company, 1873. [NRC, Building Research Division Library]

This was included in Lieutenant Colonel Cooke's "List of Books of Reference" for officers of the Royal Engineers (see Appendix, below). The section on masonry includes various cements, buttresses and arches. There is a discussion of iron fastenings in the section on metal structures. Among other topics discussed are carpentry, and water supply and drainage. This book contains much useful and practical information.

Smeaton, A.C.

The Builder's Pocket Manual, Containing the Elements of Building, Surveying & Architecture, with Practical Rules and Instructions Connected with the Subject. 2nd ed. London: M. Taylor, 1847. [Parks Canada Library]

In the preface the author states it to be his purpose "to assist the student in the acquisition of elementary knowledge." The contents of the book are divided by the various trades or departments of building, brick, mortars, cements, carpenter, joiner, mason, plasterer, etc. The section on plaster includes a discussion of the types of plaster, how to prepare and apply them, and that on painting gives instructions on how to prepare the various colours. The section on cement includes some historical information as well as practical advice on how to use cement and what to watch out for when working with it.

Stuart, Robert

A Dictionary of Architecture, Historical, Descriptive, Topographical, Decorative, Theoretical and Mechanical. 3 vols. London: Jones & Co., 1830. [DINA Library has Vols. 1 and 2; PAC Library has Vol. 1]

The introductory essay on "The Progress of Architecture in England" gives an idea of the current state of the art. Some practical information is given in the various entries; for instance, the article on windows includes information on how to calculate the size of window needed for any particular size of room.

Swan, Abraham

The British Architect. New York: DaCapo Press, 1967 (reprint of the 1758 edition). [DINA Library]

This work has plates illustrating the traditional five orders of architecture, staircases, doors and windows, chimney pieces and ornamentation, along with the rules of architecture. There is not much structural detail given except for roof trusses, as most of the detail is for ornamentation.

Trautwine, John C.

The Civil Engineer's Pocket Book. 17th ed., revised by John C. Trautwine Jr. New York: John Wiley & Sons, 1899 (first preface dated 1876). [NRC, Bulding Research Division Library]

This work includes sections on mortar, bricks, and cement and some information on hardware, such as nails. There is considerable material on the latest developments and the problems of mortars and cements.

Weale, John
Rudimentary Dictionary of Terms Used in Architecture, Civil, Architecture, Naval, Building and Construction, Early and Ecclesiastical Art, Engineering.... London: John Weale, 1849-50. [National Library]

Weale published a series of "Rudimentry Treatises" of which this was originally intended to form a part. This work contains some useful information on concrete, cement, lime and mortar. The "Rudimentary Series" included several works on engineering and architecture including one on the erection of dwelling houses by S.H. Brooks, one on roofs by Dr. Robison, one on civil engineering in North America by D. Stevens and works on architecture in general by W.H. Leeds, T. Bury, and E. Dobson. These works were recommnded by Lieutenant Colonel Cooke in his list (see Appendix, below), as useful and convenient.

3. WORKS ON PARTICULAR ASPECTS OF BUILDING

Carpentry

The Carpenters Company of the City and County of Philadelphia 1786 Rule Book. Annotated with an introduction by Charles E. Peterson. Princeton: Pyne Press, 1971. [DINA Library]

This work contains rules for measuring and valuing house carpenters' work. It is useful for the details it gives about framing doors, windows and mouldings.

Newlands, James
The Carpenter and Joiner's Assistant. Glasgow: Blackie and Son, 1865. [DINA Library; NRC, Building Research Division Library has the 1880 edition]

This work includes information on the finishing of windows and doors and on hinges and machinery. There is also a glossary of architectural and building terms.

Tredgold, Thomas
Elementary Principles of Carpentry; A Treatise on the Pressure and Equilibrium of Timber Framing...Uniting Iron and Stone with Timber etc. with Practical Rules and Examples. 4th ed. London: John Weale, 1853. [Parks Canada Library]

This work includes data on the holding power or adhesion of nails and wood screws based on tests carried out by a Mr. Bevan in England.

Glass

Cooper, William
The Crown Glass Cutter and Glazier's Manual. Edinburgh: Oliver & Boyd, 1835. [Xerox copy available, N.H.P.&S. Research Division]

This volume contains an explanation of the process of manufacturing crown glass and instructions for the cutting of tables of glass into panes, the packing of glass for shipping and the fixing of panes of glass into windows. The plates show some of the tools of the glass cutter's trade, various ways of dividing up a table of glass and designs for leaded windows. It is most useful for an understanding of early 19th-century glass manufacturing and glazing.

Powell, Henry J.
The Principles of Glass-Making. With treatises on crown and sheet glass by Henry Chance and on plate glass by A.G. Harris. London: George Bell and Sons, 1883. [Xerox copy available, N.H.P.&S., Research Division]

This work gives considerable technical detail on the manufacture of glass including descriptions of the improvements in the process which were currently taking place. Included as an appendix is a list of examination questions in the technology of glass manufacture.

Limes, Mortars and Cements

Vicat, Louis Joseph

A Practical and Scientific Treatise on Calcareous Mortars and Cements Artificial and Natural.... Translation with added notes by Capt. John Thomas Smith, Madras Engineers. London: John Weale, 1837. [British Library]

This was one of the seminal works on the subject. Vicat's work on cement and mortar was widely known in Britain and the United States. Smith's notes give added information on the work of British engineers in the field and his translation of Vicat was considered a must for study by the Royal Engineers.

Painting and Plastering

Arrowsmith, H.W. and A.

The House Decorator and Painter's Guide. London: Thomas Kelly, 1840. [Parks Canada Library]

This includes an historical treatise on interior decorating and coloured plates showing various schemes of interior decoration, which are mainly very elaborate. It gives an idea of the styles of decoration suggested for use in the more expensive homes of the period.

Millar, William

Plastering, Plain and Decorative. A Practical Treatise in the Art of Plastering and Modelling Including Full Descriptions of the Various Tools, Materials, Processes and Appliances...Accompanied by Numerous Examples. 3rd ed. London: B.T. Batsford, 1905 (first edition 1897). [Parks Canada Library]

This work includes a chapter on the manufacture of plaster and the materials used, historical background on the types of cement, information on the methods of applying plaster to walls, definitions of various terms and recipes for plaster.

4. MILITARY WRITINGS

The 19th century saw an increasing awareness of the need of military engineers for a specialized education which would train them both for duties in the field during wartime and for the numerous duties and responsibilities borne by engineer officers at the various army stations, particularly those abroad where they were far removed from any advice or instruction they might wish to obtain from headquarters. One result of this perception was a steadily growing body of writings on military engineering. Perhaps the most important of these were the papers which appeared in the several series of the Professional Papers of the Corps of Royal Engineers and the Aide Memoire prepared by a committee of engineer officers to serve as a reference work particularly for officers in the field. Also extremely important were the works prepared by Lieutenant Colonel Pasley, the founder of the School of Military Engineering at Chatham.

Aide Memoire to the Military Sciences Framed from Contributions of the Different Services, and Edited by a Committee of the Corps of Royal Engineers. 2nd ed. London: John Weale, 1853-62. [Parks Canada Library]

The Aide Memoire grew out of a suggestion for a Royal Engineer encyclopedia. It was produced by a committee of officers consisting of G.G. Lewis, Harry Jones and Richard John Nelson, who were at the time engineer officers serving in Ireland. Contributions were requested from all officers in the corps and covered most of the standard military engineering subjects as well as related fields. The editors stated that the work had been completed in order "to supply as far as practicable, the many and common wants of Officers in the Field, in the Colonies, and remote Stations,

where books of reference are seldom to be found, useful to the Engineer, Artillery, and Line Officer, in their military capacity, as well as the Governors and Commandants of Posts in their civil capacity, and instructive to all the junior branches of the Service in their leisure hours." It was not intended "as a Military Dictionary...or even a Manual, but as a reminder and reference - for which short Essays and Tables are given - to the military and collatoral sciences previously studied." The topics covered included the duties required of engineers in garrison, and considerable information on construction was given.

Collinson, Thomas Bernard

General Sir Henry Drury Harness, K.C.B., Colonel Commandant Royal Engineers. The material for this memoir was collected and arranged by the late General Collinson, RE, and edited by General Webber. London: [Royal Engineers Institute Committee], 1903. [Cambridge Military Library, Halifax]

Harness was director of the Royal Engineer establishment at Chatham for a time, and this memoir includes information about the education of engineers there. Collinson also collected notes and extracts on the practice of building which were widely used by the Royal Engineers.

Great Britain. Corps of Royal Engineers

Professional Papers. These were published more or less annually from 1837 until after 1900, in several series, with two indexes, one covering the years 1837-1872 and one covering the whole series up to 1892. The main series were as follows:

Papers on Subjects Connected with the Duties of the Corps of Royal Engineers (referred to in the index as "Quarto Series"). Vols. 1 and 2 published in London by J. Barker, 1837-38; Vols. 3-10 published in London by J. Weale, 1839-49.

Corps Papers and Memoirs on Military Subjects Compiled from Contributions of the Officers of the Royal Engineers and the East India Company's Engineers (also known as "Intermediate Series"). Issued in parts and then collected together in one volume. London: John Weale, 1849-50.

Papers on Subjects Connected with the Duties of the Corps of Royal Engineers Contributed by Members of the Royal and East India Company's Engineers and Edited by a Committee of Royal Engineers (short title Professional Papers, New Series). Vols. 1-3 published in London by John Weale, 1851-53; Vols. 4-23 published in Woolwich by W. & P. Jackson, 1855-76.

Professional Papers of the Corps of Royal Engineers - Royal Engineer Institute Occasional Papers (known as Occasional Papers). 30 vols. Chatham: Royal Engineer Institute, 1877-1904.

There were as well Prize Essays, a Confidential Series, and Foreign Translations, at least. The DND Library and the NRC, Building Research Division Library have fairly complete runs of the Quarto Series, New Series and Occasional Papers. The DND Library catalogue lists the Intermediate Series, but this volume was not on the shelves. PAC Library has Vols. 1 to 9 of the Quarto Series and Part 2 of the Intermediate Series.

The Professional Papers were part of an effort by engineer officers to keep informed on new developments in both military and civil engineering and to share with thier fellow officers knowledge gained in the course of their duties. Experiments were reported and commented upon; significant events in the history of the corps could be discussed. Among the numerous papers of value for a study of military building technology the following illustrate some of the concerns of engineer officers of the period:

"Hints for the compilation of an Aide Memoire for the Corps of Royal Engineers" (Quarto Series, Vol. 1)

"Description of Barracks at Lucia in Jamaica" (Quarto Series, Vol. 2).

"Experiments tried at Quebec as to the properties and adhesive qualities of cements" (Quarto Series, Vol. 3)
"Practical Essay on the strength of cast iron beams, girders and columns" (Quarto Series, Vol. 6)
"Remarks on the use of Asphalte [sic] in Cold Climates" (New Series, Vol. 5)
"Account of a new Cement" (New Series, Vol. 6)
"Syllabus of the Studies, Duties, etc. etc. of an Officer of Royal Engineers" (New Series, Vol. 7)
"On the Principle of Design in Architecture" (New Series, Vol. 12)
"Experiments on Limes and Cements" (New Series, Vol. 14)
"The American Flat Fire Proof Asphalting or Tarred Roofing" (New Series, Vol. 23)

Many of the early contributors to the Professional Papers also contributed to the Aide Memoire. The Professional Papers give an insight into the state of military engineering and its development during this period.

Great Britain. Royal Engineer Establishment, Chatham.

Particularly valuable for a knowledge of what the Royal Engineers learned during their studies is a series of volumes based on their course of instruction, available at the Royal Engineers Library at Chatham. A synopsis of the course of military instruction at Chatham was drawn up in 1853 by order of the Director of the Royal Engineer Establishment, Col. Harry D. Jones. The library at Chatham now holds copies of the 1855 and 1863 revisions of this synopsis. In the early 1870s Colonel Henry Wray prepared a text book entitled Some Applications of Theory to the Practice of Construction, with Examples, Being a Part of the Course of Instruction at the School of Military Engineering, Chatham. The Royal Engineers Library holds several editions of this text, including one printed in 1891 which had been revised by Colonel H.C. Seddon. In 1879 the first volume of Notes on the Materials Used in the Construction of Engineering Works, Forming Part of the Course of Instruction at the School of Military Engineering, with a chapter on stone by Colonel Wray and the remainder of the book by Major Percy Smith, was printed for the use of the officers of the Royal Engineers. The second volume of this work, written by Major Smith, was issued in 1881. In 1888 S.R. Maycock's Notes on the Chemistry of Building Materials, another synopsis of a course at the School of Military Engineering, was printed. Through these various text books one can trace changes in what the Royal Engineers learned about building technology and construction practices.

Great Britain. War Office.

Orders and Regulations for the Guidance of the Corps of Royal Engineers and Royal Sappers and Miners. London: J. Hartmill, 1832. [DND Library]

Every officer was directed to possess a copy of this volume and to keep it up to date. Information is given on papering of offices and houses for various classes of persons, regulations on painting, the protection of glass and type of glass to be used, and regulations for the use of locks, nails and window hardware. Nails, screws and spikes were to be described agreeably with the book issued to stations on 20 March 1826.

Great Britain. War Office.

Priced Vocabulary of all Stores used in Her Majesty's Service and Provided by the Control Department, Clothing Excepted. Royal Arsenal, Woolwich: 1870. [PAC Library; Cambridge Military Library, Halifax, has a 1915 edition]

This work includes accoutrements, small arms, artificers' tools, cement of various types, glass (prices are given for special types of glass, i.e. glass for photography, but not for common glass), lime, locks (various types are listed), nails (listed with reference number), paint and timber.

Head, Sir Francis Bond

The Royal Engineer. London: J. Murray, 1869. [DND Library; National Library; Cambridge Military Library, Halifax]

This book outlines at great length the courses available at the School of Military Engineering at Chatham. Head had begun his career as an engineer and left in the 1830s feeling that there was no room for advancement. This volume is the outcome of a lengthy visit to the school to study the courses offered and the education received by young engineers.

Pasley, Charles William

Observations on Limes, Calcareous Cements, Mortars, Stuccos and Concretes. London: John Weale, 1838. [Parks Canada Library]

Pasley was the founder of the School of Military Engineering at Chatham and his writings show the sort of instruction engineer officers were receiving and the advances in knowledge of building materials and technology being made by engineers in the early 19th century. This work contains several discoveries resulting from experiments at Chatham which led to the manufacture of artificial cements in large quantities. It became one of the standard works on the subject for military engineers.

Pasley's Outline of a Course of Practical Architecture, a copy of which is available at the Halifax Defence Complex, was lithographed in 1826 for the use of the Establishment for Field Instruction, Royal Engineer Department, Chatham. This work is a most valuable aid in understnding the education and knowledge of military engineers. There are extensive sections on mortars and cement, and on brickwork.

APPENDIX

Extracts from "A List of Books of Reference on Professional and Scientific Subjects" by Lt. Col. A.C. Cooke, RE.

This list appeared in Vol. 15 (1866) of the Royal Engineers' Professional Papers (New Series). In Vol. 16 several books on architecture were added to the list. The object of the list was to furnish engineer officers with the names of reliable books of reference on the different professional and scientific subjects with which they had to deal.

ARCHITECTURE

1. **RICKMAN'S GOTHIC ARCHITECTURE.** An attempt to discriminate the styles of architecture in England from the Conquest to the Reformation, with a sketch of the Grecian and Roman orders, by the late Thomas Rickman, F.S.A., 6th edition, with considerable additions, chiefly historical, by John Henry Parker, F.S.A. Published by John Henry and James Parker, 1862. Size 9 in. by 6 in. by 1 3/4 in. Price about 17s. 6d.

2. Weale's Series: 16, 17, 18, 19.

CIVIL ENGINEERING

General

1. **RANKINE'S CIVIL ENGINEERING.** A manual of Civil Engineering, by William John Macquorn Rankine, Civil Engineer, LL.D., F.R.S., Regius Professor of Civil Engineering and Mechanics in the University of Glasgow, &c., &c., with numerous diagrams. Published by Charles Griffin and Co., London. 2nd edition, revised 1863. Size, 7 1/2 in. by 5 in. by 2 in. Price 16s.

This work enters fully into the mathematical investigation of engineering problems, and deals largely with the calculus. Its contents are shewn in the following extract from the preface: -

"This work is divided into three parts. The first relates to those branches of the operations of engineering which depend upon geometrical principles alone, that is to say, surveying, levelling, and the setting out of works comprised under the general name of engineering geodesy or field work. The second part relates to the properties of the materials used in engineering works, such as earth, stone, timber, and iron, and the art of forming them into structures of different kinds, such as excavations, embankments, bridges, &c. The third part, under the head of combined structures, sets forth the principles according to which the structures described in the second part are combined into extensive works of engineering, such as roads, railways, river improvements, waterworks, canals, sea defences, harbours, &c.

2. CRESY'S ENCYCLOPAEDIA OF ENGINEERING. An encyclopaedia of civil engineering, historical, theoretical, and practical, by Edward Cresy, Architect and Civil Engineer. Illustrated by upwards of 3,000 engravings on wood. Published by Longman. New edition with a supplement, in 2 vols., 1856. Size, first vol. 8 1/2 in. by 6 in. by 1 1/2 in.; second vol., 8 1/2 in. by 6 in. by 2 in. Price £3 13s 6d.

The greater part of the first volume is devoted to a history of the progress of civil engineering in all nations, beginning at the Phoenicians, including an outline of the nature and construction of the more important works executed by each, such as docks, harbours, lighthouses, bridges, roads, drainage works, railroads, &c. This volume contains also an article on geology and the different sorts of stones, bricks, and mortars used in building. The contents of the second volume are, outlines of geometry and properties of figures, principles of valuation of property, data for calculating the cost of different sorts of artificers' work, and the information and details necessary for the construction of all kinds of engineering works. This work is considered by some as rather obsolete.

3. COURS DE CONSTRUCTION. SGANZIN. Programme ou resumé des leçons d'un cours de construction avec des applications tirées spécialement de l'art de l'ingénieur des ponts et chaussées; ouvrage de feu M. J. Sganzin, quatrième édition, enrichie d'un atlas volumineux, entièrement réfondue et considérablement augmentée avec les notes et papiers de l'auteur, avex ceux de M. de Lamblardié fils, par M. Reibell, 1839. Published by Carilian Goeury et V. Dalmont, Paris, in 3 volumes, with a large atlas of plates. Size of each volume, 11 in. by 8 1/2 in. by 1 in. Price about 7s. 6d. a volume.

The 1st volume treats of, resistance of materials, foundations in general, ordinary roads, railroads, bridges and viaducts in masonry, wood and metal, suspension bridges, moveable bridges.

The 2nd volume treats of, internal navigation on rivers, artificial navigation, irrigation, drainage, aqueducts, sewers, artesian wells, subjects connected with maritime navigation, viz, wind, waves, currents, sandbanks, ports, moles, breakwaters, jetties, basins, harbours, docks, &c.

The 3rd volume continues the subject of maritime navigation, and treats of removal of deposits, hydraulic works in connection with the construction, docking, loading, and repairing of ships of war and merchantmen, dry docks, maritime establishments, and arsenals &c.

4. MAHAN'S CIVIL ENGINEERING. An elementary course of Civil Engineering for the use of Cadets of the United States Military Academy, by D.H. Mahan, M.A., Professor of Military and Civil Engineering in the Military Academy. Published by John Wiley, New York; 6th edition, with large addenda and many cuts, 1864. Size, 10 in. by 6 in. by 1 1/4 in. Price, 18s.

This work treats of mortars and cements, brick, properties of different sorts of timber, metals, varnishes, and paints; strength of different building materials exposed to different strains, masonry, iron and timber framing; construction of bridges, roads, railroads, canals, river and sea-coast improvements.

5. HEBERT. ENGINEERS' AND MECHANICS' ENCYCLOPAEDIA. Comprising practical illustrations of the machinery and processes employed in every description of manufacture of the British Empire; with nearly 2000 engravings by Luke Hebert, Civil Engineer, &c., &c. In 2 vols. Published by Thomas Kelly. A new edition, with considerable additions and improvements, 1856-61. Size 7 in. by 4 in. by 1 1/2 in. Price £ 10s.

This work is arranged as a dictionary.

Smeaton's Reports, Tracts, and Eddystone Lighthouse are classical works in Civil Engineering, but they are scarce, bulky, and expensive, and not adapted for books of reference.

6. Weale's Series, 13, 14, 15, 15*, 22, 118, 119.

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Bridges and Iron Structures

9. HUMBER ON IRON BRIDGE CONSTRUCTION. A complete treatise on cast and wrought-iron bridge construction, including iron foundations; in three parts, theoretical, practical, and descriptive, illustrated by numerous examples drawn to a large scale, by William Humber. Vol. 1, text 15 in. by 10 1/2 in. by 1 in. Vol. 2, plates 15 in. by 10 in. by 1 1/2 in. Published by E. & F.N. Spon, 1861. Price £6 16s. 6d.

10. LATHAM ON WROUGHT-IRON BRIDGES. The construction of wrought-iron bridges, embracing the practical application of the principles of mechanics to wrought-iron girder work, by John Herbert Latham, M.A., C.E., Fellow of Clare College Cambridge, with numerous detail plates. Published by Macmillan & Co., 1858. Size, 9 in. by 5 3/4 in. by 3/4 in. Price 15s.

This work enters very fully into the theory and calculations of the weights and strains on all portions of girder work.

11. SHIELDS ON IRONWORK. The strains on structures of ironwork, with practical remarks on iron construction, by F.W. Shields, Member of Institution of Civil Engineers. Published by Weale, 1861. Size, 9 1/2 in. by 6 in. by 1/4 in. Price 5s.

This is a very clear and practical work. It gives short practical rules, without the use of the calculus, for determining the strains on different portions of iron structures.

12. FAIRBAIRN'S RESEARCHES ON THE APPLICATION OF IRON TO BUILDINGS. On the application of cast and wrought-iron to building purposes, by William Fairbairn, C.E., F.R.S., F.G.S., &c. Published by Longman. 3rd edition, greatly enlarged with corrections and additions, to which is added a short treatise on wrought-iron bridges, with additions, &c., 1864. Size, 10 in. by 6 1/2 in. by 1/2 in. Price 16s.

This work gives a series of experiments on cast-iron simple and trussed beams, and on wrought-iron beams and trellis girders, with the results deduced from them. Also the details of construction of fire-proof buildings. To the 3rd edition is added the adaptation of malleable iron beams, or girders, for the construction of bridges, with formula from which to calculate the strains on the struts and tension bars of lattice bridges.

13. HAUPT ON BRIDGE CONSTRUCTION. General theory of bridge construction, containing demonstrations on the principles of the art and their application to practice; furnishing the means of calculating the strains upon the chords, ties, braces, counter-braces, and other parts of a bridge or frame of any description, with practical illustrations, by Herman Haupt, A.M., Civil Engineer. Published by D. Appleton and Company, 200, Broadway, New York, 1856. Size, 9 1/4 in. by 6 in. by 1 in. Price 16s.

This is a very clear and practical work, and the calculations are for the most part made without the use of the calculus.

14. FAIRBAIRN ON CONWAY AND MENAI TUBULAR BRIDGES. An account of the construction of the Conway and Britannia Tubular Bridges, with a complete history of their progress from the conception of the original idea to the conclusion of the elaborate experiments which determined the exact form and mode of construction ultimately adopted. By William Fairbairn, C.E., &c. Published by Weale and Longman, 1849. Price £2 2s. Very scarce.

15. BAKER'S DIAGRAMS OF IRON GIRDERS. Giving weights of iron girders up to 200 feet span, by B. Baker. Published by Spon, 1866. Price 3s.

16. HAM AND HOSKING ON BRIDGE CONSTRUCTION*. [f.n. this has been recommended to me but I have not had an opportunity of examining it. A.C.C.]

17. HODGKINSON ON CAST-IRON. Experimental researches on the strength and other properties of cast-iron, with the development of new principles, calculations deduced from them, and enquiries applicable to rigid and tenacious bodies generally, by Eaton Hodgkinson, F.R.S., with plates and diagrams. Published by Weale. 2nd edition, 1861. Size, 8 1/2 in. by 5 1/2 in. by 3/4 in. Price 6s.

This gives the experiments made for determining the strength of iron under different circumstances, and the results deduced from them as to the best form and necessary dimensions of iron beams, pillars, &c., when subject to different strains. It forms a continuation of the 5th edition of Tredgolds' Practical Essay on the strength of cast-iron and other metals, containing practical rules, tables, &c., edited by Hodgkinson. The price of the two together is 16s.

18. BARLOW ON THE STRENGTH OF TIMBER. A treatise on the strength of timber, cast and malleable iron, and other materials; with rules for application in architecture, the construction of suspension bridges, railways, &c.; and an appendix on the power of locomotive engines, and the effect of inclined planes and gradients, with 7 plates, by Peter Barlow, F.R.S., Member of the Institution of France, &c. A new edition revised and corrected by J.F. Heather, M.A., of the Royal Military Academy, Woolwich, to which is added an essay on the effects produced by causing weights to travel over elastic bars, by the Rev. Robert Willis, M.A., F.R.S., &c., with 9 illustrations. Published by Weale, 1851. Size, 8 1/2 in. by 5 1/2 in. by 1 1/2 in. Price 16s.

19. EXPERIMENTS ON WROUGHT-IRON AND STEEL. KIRKALDY. Results of an experimental enquiry into the tensile strength and other properties of various kinds of wrought-iron and steel, by David Kirkaldy. Illustrated by numerous plates and diagrams. Printed for and sold by the author, at Glasgow. 2nd edition, 1863. Size, 9 in. by 6 in. by 1 in. Price 18s.

This work gives the details and results of a series of experiments on the tensile strength of all sorts of wrought-iron and steel, made by the author at the works of Messrs. Napier, in Glasgow, from 1858 to 1861. It treats of the tensile strength only, and does not comprise cast-iron, for which, see Hodgkinson.

20. BUCK ON OBLIQUE BRIDGES. A practical and theoretical essay on oblique bridges, by George Watson Buck, C.E. 2nd edition, corrected, and with the addition of description to diagrams for facilitating the construction of oblique bridges, by W.H. Barlow, C.E. Published by Weale, 1857. Size, 11 in. by 7 1/2 in. by 1/2 in. Price 12s.

This work gives the problems and practical instructions necessary for carrying out the details of oblique stone bridges.

21. Weale's series, 43, 124, 124*

Carpentry

22. TREDGOLD'S CARPENTRY. Elementary principles of carpentry; a treatise on the pressure and equilibrium of timber framing, the resistance of timber and

the construction of floors, centres, bridges, roofs, uniting iron and stone with timber. With practical rules and examples to which is added an essay on the nature and properties of timber, including the methods of seasoning and the causes and prevention of decay, with description of the kinds of wood used in building; also numerous tables of the scantlings of timber for different purposes, the specific gravities of materials, &c., illustrated by 50 engravings and several woodcuts, by Thomas Tredgold, Civil Engineer, &c., &c. Third edition, corrected and considerably enlarged, with an appendix containing specimens of various ancient and modern roofs, by Peter Barlow, F.R.S., &c., &c. Published by John Weale; 4th edition, 1853. Size, 11 in. by 9 in. by 2 in. Price £2 2s.

23. Weale's Series, 123, 123*.

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Gas Works.

29. WEALE'S RUDIMENTARY TREATISE, 82, 83*, 83 bis; GAS WORKS.** - A treatise on gas works and the practice of manufacturing and distributing coal gas, with some account of the most approved methods of distilling coal in iron, brick, and clay retorts, and of the various modes adopted for purifying coal gas, including also a chapter on the hydro-carbon or water gas, and on the rating of gas works in parochial assessments, by Samuel Hughes, C.E. Published by John Weale. Size, 7 in. by 4 in. by 3/4 in. Price 3s.

Hydraulics.

30. BEARDMORE'S MANUAL OF HYDROLOGY, containing: I, hydraulic and other tables; II, rivers, flow of water, spring wells, and percolation; III, tides, estuaries, and tidal rivers; IV, rainfall and evaporation; by Nathaniel Beardmore, C.E. Published by Waterlow & Sons, London; 1862. Size, 9 in. by 6 in. by 1 1/4 in. Price 7s. 6d.

This work enters into all matters connected with the fall, accumulation, flow, and discharge of water. The following are the principal subjects treated of: Rules and tables for calculating rate of discharge and velocities under all conditions, for sluices, tanks, reservoirs, sewers, rivers, drains, culverts, gas, and water pipes; expansion of water, steam, and gas; value of water power; water supply and flood discharges for different falls of rain; tables of useful weights and measures; properties of circles, logarithms, &c.; weight and strength of building materials; proportion between the fall, evaporation and percolation of rain under different circumstances; discharge of rivers; velocity, rise, and fall of tides. It gives also the dimensions of iron pipes for different pressures of water, but not those of lead pipes.

31. STEVENSON ON HARBOURS. - The design and construction of harbours, by Thomas Stevenson, F.R.S.E., &c. Reprinted and enlarged from the article "Harbours," in the 8th edition of the Encyclopaedia Britannica. Published by A. and C. Black, 1864. Size, 9 in. by 5 3/4 in. by 3/4 in. Price 4s. 6d.

This work treats of the different classes of harbours; their geological features; generation and force of waves; construction of harbours in deep water and of tidal harbours; design of ground plan of harbours; materials employed and miscellaneous subjects connected with harbours.

32. Report of Royal Commission, 1859, on Harbours of Refuge. Blue book, with plates.

33. STEVENSON. IMPROVEMENT OF TIDAL RIVERS. - Remarks on the improvement of tidal rivers, illustrated by reference to works executed on the Tay, Ribble, Forth, Lune, and other rivers, by David Stephenson, F.R.S.E., &c. Published by Weale. Size, 9 in. by 6 in. by 1/4 in. Price 4s. 6d.

34. BAIRD SMITH'S ITALIAN IRRIGATION. - Being a report on the agricultural canals of Piedmont and Lombardy, addressed to the Court of Directors of the East India Company, by R. Baird Smith, F.G.S., Captain of Engineers, Bengal Presidency. Published by authority. Vol. I, Historical and descriptive; Vol. II, Practical and legislative. Published by William Blackwood & Sons, 1855. Size, 9 in. by 5 1/2 in. by 1 1/4 in. Price £1 10s.

This work is the result of a mission on which Captain Smith was sent by the Directors of the East India Comany to investigate the irrigation systems of Northern Italy, with a view to the improvement of those of India. The 1st volume gives a historical and descriptive account of the principal irrigation works of Piedmont and Lombardy, and of those of India in an appendix. The 2nd volume enters into the details of the works, including the necessary conditions for forming water meadows; the methods by which the water is conducted over them; the cost and profits of the different works; the methods adopted for measuring the quantity supplied so as to regulate the charges made to the different proprietors; and the legislative enactments on the subjects which have been made in Italy.

35. Weale's Series, 82***, 120, 121, 122.

There are other standard works, such as Rennie's British and Foreign Harbours; Minard's Works, &c., which are very bulky and expensive.

Lighthouses.

36. Weale's Series, 47, 48, 49; Lighthouses.

Limes, Mortars, and Cements.

37. PASLEY ON CEMENTS. - Observations on limes, cements, mortars, stuccoes, and concretes, and on Puzzolanas, natural and artificial, together with rules deduced from numerous experiments for making an artificial water cement equal in efficiency to the best natural cements of England, improperly termed Roman cements; and an abstract of the opinion of former authors on the same subject, by Major General Sir C.W. Pasley, K.C.B., F.R.S., &c., &c. Published by Weale; 2nd edition, 1847. Size, 9 in. by 6 in. by 3/4 in.

38. PROFESSIONAL PAPERS OF THE CORPS OF ROYAL ENGINEERS, VOL. XI, NEW SERIES, 1862, Paper 3. - Observations on limes and cements, their properties and employment, by Captain Scott, Royal Engineers.

39. VICAT ON MORTARS AND CEMENTS. - A practical and scientific treatise on calcareous mortars and cements, artificial and natural; containing directions for ascertaining the qualities of the different ingredients, for preparing them for use, and for combining them together in the most advantageous manner; with a theoretical investigation of their properties and modes of action. The whole founded upon an extensive series of original experiments, with examples of their practical application on the large scale, by L.J. Vicat, Engineer in chief of bridges and roads, formerly pupil of the "École Polytechnique," member of the Legion of Honour, &c., &c. Translated with the addition of explanatory notes embracing remarks upon the results of various new experiments, by Captain J.T. Smith, Madras Engineers, F.R.S., &c. Published by Weale, 1837. Size, 8 1/2 in. by 5 1/2 in. by 1 in. Price 3s. 6d. This work is very scarce.

40. TOTTEN ON MORTARS. - Essays on hydraulic and common mortars, and on lime burning; translated from the French of General Freussart, M. Petot, and M. Courtois, with brief observations on common mortars, hydraulic mortars, and concretes, and on account of some experiments made therewith at Fort Adams, Newport Harbour, from 1825 to 1838, by J.G. Totten, Lieut. Colonel of Engineers and Brevet Colonel, United States Army. Published by Wiley and Putnam, New York, 1842. Size, 9 in. by 6 in., by 3/4 in. This work is out of print.

41. Weale's Series, 45.

Masonry and Stonecutting.

42. Weale's Series, 25, 26.

Mechanics.

43. MOSELEY'S ENGINEERING AND ARCHITECTURE. The mechanical principles of Engineering and Architecture, by Henry Moseley, M.A., F.R.S., Chaplain in ordinary to the Queen, Canon of Bristol, Vicar of Olveston, &c. Published by Longman. 2nd edition, 1855. Size, 9 in. by 5 1/2 in. by 1 3/4 in. Price £1 4s.

This work treats of Statics and Dynamics; the pressure on and work done by different machines; the laws of stability of structures, including walls, piers, buttresses, arches, strains on loaded beams, &c. It embraces a most complete investigation of the principles of construction of machines and buildings.

44. WEISBACH. MECHANICS OF MACHINERY, &c. Principles of the mechanics of Machinery and Engineering, by Julius Weisbach, Professor of Mechanics and applied Mathematics in the Royal Mining Academy of Frieberg. In two vols., illustrated with one thousand engravings on wood. The translation from the German forms vols. 2 and 5 of the library of illustrated standard scientific works. The 1st volume contains the theory of mechanics; the 2nd, their practical application. Size, 8 1/2 in. by 5 1/2 in. by 1 1/2 in. Price £2 2s.

45. FENWICK'S MECHANICS OF CONSTRUCTION. Including the theories of the strength of materials, roofs, arches, and suspension bridges, with numerous examples, by Stephen Fenwick. 8 vo., 1861. Price 12s.

46. APPLETON'S DICTIONARY OF MECHANICS. Dictionary of machines, mechanics, engine work, and engineering, illustrated with 400 engravings on wood, in 2 volumes. Published by D. Appleton and Co., New York. 2nd edition, 1857. Size, 10 1/2 in. by 7 in. by 2 3/4 in. each vol. Price £2 10s.

The following extracts from the preface show the design of this work.

"This dictionary is intended to be a dictionary of machines, mechanics, engine work, and engineering; to present concisely and compendiously the details of valuable machines in actual use, the laws of matter and their application, the construction and proportions of parts of engines and millwork, together with the most successful and useful examples in engineering." "To shew, therefore, the advance of the mechanical arts, both here and abroad, to define their exact position at the present time as far as possible, but more particularly in regard to machinery, to make, as it were, a 'World industrial exhibition' of useful machines, and a record of their application is the object of the present work."

47. Weale's Series, 98, 98*, 114.

Doctor Robison's Mechanical Philosophy is a standard work, but it is of old date and very scarce.

See also **MATHEMATICS.**

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Roads and Railroads

50. A TREATISE ON ROADS BY SIR H. PARNELL. Wherein the principles on which roads should be made are explained and illustrated by the plans, specifications, and contracts made use of by Thomas Telford, Esq., on the Holyhead road, by the Right Honorable Sir Henry Parnell, Bart. Published by Longman, Rees, Orme, Brown, Green, and Longman, London, 1833. Size, 9 in. by 6 in. by 1 1/2 in. Price £1 1s.

52. GILLESPIE ON ROADS AND RAILROADS. A manual of the principles and practice of road making, comprising the location, construction and improvement of

roads (common, macadamized, paved, plank, &c.), and railroads, by W.M. Gillespie, A.M., C.E., Professor of Civil Engineering in Union College. Published by A.S. Barnes & Co., New York. 6th edition, with additions, 1853. Size, 8 1/2 in. by 5 1/2 in. by 1 in. Price 9s.

This work enters into all the principles and details, the knowledge of which is necessary in the construction of roads, including laying-out, slopes, cross-section, materials, surface, cost, &c. A small portion is devoted to railroads.

52. DEMPSEY. PRACTICAL RAILWAY ENGINEER. A concise description of the engineering and mechanical operations and structures which are combined in the formation of Railways for public purposes, embracing an account of the principal works executed in the construction of railways to the present time, with facts, figures, and data, intended to assist the Civil Engineer in designing and executing the important details required for those great public works. By G. Drysdale Dempsey, C.E. 4th edition, revised, and greatly enlarged. Published by John Weale, 1855. Size, 11 in. by 9 in. by 2 1/2 in. Price £2 12s. 6d.

53. PERDONNET. CHEMINS DE FER. Traité élémentaire de chemins de fer par Aug. Perdonnet, administrateur des chemins de l'est de la France et de l'ouest de la Suisse, membre du comité de direction des chemins de fer de l'est de la France, président honoraire de la société des Ingénieurs Civiles de France, &c., &c. Published by Langlois et Leclerq, Paris. 2nd edition, 1858, two volumes. Size, 9 in. by 5 1/2 in. by 2 in. Price £1 10s.

This work gives a history of the progress of railways in different countries, and enters into all matters connected with their construction and cost, the different sorts of rails, chairs, &c., in use, carriages, locomotives, &c. The following extract from the preface shews the scope of the work. "Tracer en peu de mots l'histoire des chemins de fer, esquisser l'art de les construire, tel est le but que nous nous sommes proposé dans cet ouvrage."

54. Weale's Series, 46, 62, 62*.

Roofs.

55. Weale's Series, 124, 124*.

See also **CARPENTRY AND BRIDGES** and **IRON STRUCTURES.**

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Steam Engine.

57. TREGOLD ON STEAM ENGINES. - 1st Vol. The principles and practice and explanation of the machinery of locomotive engines in operation on the several lines of railway, exemplified in the examples constructed by different eminent engineers; with descriptive text, to which are added rules and regulations for the practical management of a locomotive engine, with experiments on the resistance of railway trains, by J. Sewell, Great Western Railway. The dimensions of the locomotive engine boiler in relation to its expansive powers, by R. Armstrong. The consumption of fuel and the evaporation of water, by E. Woods, Liverpool. Forming the 1st vol. of the new edition of Tredgold on the steam engine. 1850.

2nd Vol. The principles and practice and explanation of the machinery of steam navigation; examples of British and American steam vessels; and papers on the properties of steam and on the steam engine in its original application, originally compiled by Thomas Tredgold, C.E.; amended in this edition, with the addition of recent examples of the inventions of the Engineers of the east and west coasts of the Atlantic. 1851. Part 1, text; Part 2, plates.

3rd Vol. The principles and practice and explanation of the construction of the steam engine, including pumps, stationary and marine engines; examples of boilers

used for steam navigation, and of those employed in Her Majesty's Service; together with an example of the Turbine wheel; including also the new subjects contained in the present amended edition of the late Mr. Tredgold's book; a glossary of terms applicable to marine engines and boilers, with French and Spanish translations; and a general index, 1852-3. The whole consists of 3 vols. of text and one of plates. Size of each, 12 1/2 in. by 10 in. by 1 1/2 in. to 2 in. Published by Weale. Price £4 14s. 6d.

58. BOURNE'S CATECHISM OF THE STEAM ENGINE. In its various applications to mines, mills, steam navigation, railways, and agriculture; with practical instructions for the manufacture and management of engines of every class, to which is prefixed an introductive description of all recent improvements, by John Bourne, C.E. Published by Longman. 11th edition, 1865. Size, 7 in. by 4 1/2 in. by 2 in. Price 9s.

The same author has also published a handbook of the steam engine, containing all the rules required for the right construction and management of engines of every class, constituting a key to the catechism of the steam engine. 1865. Size, 7 in. by 4 1/2 in. by 1 1/2 in. Price 9s.

59. Weale's Series, 34, 78, 78*, 79, 79*, 80, 81.

Surveying.

60. HASKOLL. THE PRACTICE OF ENGINEERING FIELD WORK. Applied to land, hydrographic and hydraulic surveying and levelling for railways, canals, harbours, towns' water supply, ranging curves and centre lines, gauging streams, &c., including the description and use of surveying and levelling instruments, and the practical application of trigonometrical tables, illustrated by numerous plans and diagrams by W. Davis Haskoll, Civil Engineer, author of "Railway Contractors," &c. Published by Atcherley and Co., 1858. Size, 9 in. by 5 1/2 in. by 1 in.

61. Weale's Series, 60, 61, 117.

See also **GEODESY.**

Water-Works, see **Hydrology.**

The Engineers' and Contractors' Pocket Book, published annually by Weale, contains a great deal of useful information on all engineering matters.

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ADDENDUM TO LIST OF BOOKS OF REFERENCE ON PROFESSIONAL AND SCIENTIFIC SUBJECTS.

From Vol. 16 of the Professional Papers (New Series).

BY LIEUTENANT COLONEL COOKE, R.E.

In the list of books of reference given in the last Vol. of the Professional Papers, those relating to Architecture were left incomplete, and the following are now added to supply the omission.

GWILT'S ARCHITECTURE. An encyclopaedia of Architecture by Joseph Gwilt. A new edition with alterations and considerable additions by Wyatt Popworth. Additionally illustrated with nearly 400 engravings in wood, by O. Jewett. Longman, 1867. Size, 9 in. by 6 in. Price, £2 2s. 6d.

The following are the subjects treated of. The history of architecture, being a short account of the styles that have prevailed in all countries. The theory of architecture, comprising - mathematics as applicable to architecture; a description

of the materials used in building; methods of construction in arches, girders, roofs, &c.; carpentry, masonry, glazing, plastering, painting, specifications, &c.; drawing and perspective. The practice of architecture, comprising - the theory of beauty in architecture; details of construction of the different orders; details of windows, staircases, rooms, and other parts of a building; buildings adapted to different pruposes.

This is a most valuable work of reference.

HISTORY OF ARCHITECTURE. FERGUSSON. A history of Architecture in all countries from the earliest times to the present day, by James Fergusson, F.R.S. &c. Three vols., 1865 to 1867. Published by Murray. Size, 9 in. by 6 in. by 2 1/4 in. Price, 1st vol., £1 15s; 2nd vol., £1 15s; 3rd vol. £1 6s. 6d.

The first two volumes embody, with additions, the information contained in the "Handbook of Architecture," and the third, that contained in the "History of Modern Architecture," by the same author. The first two volumes are divided into an introduction and three parts. The introduction comprises the theory and ethnography of architecture; the first part, ancient architecture; the second part, Christian architecture; the third part, Pagan architecure.

The first volume contains the theory of the principles of beauty in architecture, and an outline of the Egyptian, Assyrian, Grecian, Etruscan, and Roman styles. It then continues with a description of Christian architecture, up to the end of the Gothic period, in France, Belgium, Holland, Germany, and Scandinavia.

The second volume contains the continuation of Christian architecture in England, Spain, Portugal, Italy, and in countries where the Byzantine style prevailed. It concludes with an outline of Pagan architecture in Persia, India, China, Mexico, and Peru.

The third volume contains an account of the renaissance and other styles, which arose after the decline of the Gothic.

This most interesting work treats of architecture more from an aesthetic than a practical point of view. Whether the somewhat dogmatic opinions of the author are always accepted or not, this work cannot fail to be of value to those who wish to understand what are the principles of beauty in architecture, and how far they have been carried out in the styles of different nations.

A very valuable work on projections for maps has just been published in Paris, which enters more fully into the theoretical part of the subject than Hughes' Manual of Geography, given at page 120, vol. xv. It is entitled **TRAITÉ DES PROJECTIONS DES CARTES GÉOGRAPHIQUES.** Représentation plane de la Sphère et du Sphéroide par A. Germain, ancien élève de l'école Polytechnique, &c., &c. Première partie: Théorie des projections. Deuxième partie: construction et usage des principales projections. Accompagnées de 14 planches gravées. Ouvrage approuvé par S. Exc. le Ministre de la Marine et des Colonies. Published by Arthus Bertrand, Paris. Size, 9 in. by 6 in. by 1 1/2 in. Price 15 francs (about 12s.)

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