This is an admirable standpoint, and one which should ensure the book a reading from all earnest students.

Unfortunately, there are a number of defects that impair its usefulness as a text-book. In the effort to enhance its didactic value by adhering to the inductive method, systematic treatment has been neglected. Descriptions of apparatus, operations and manipulations are introduced in such sequence as may afford the student progressive practice, indeed, but in no strictly logical order. As there is a very scanty index, it is impossible to refer to particular operations, for instance, without reading the book through. Unnecessary verbiage, frequent repetitions of facts already stated, facts connected very remotely with the subject in hand, tend to break the continuity and unnecessarily to increase the bulk of the volume.

Several times the wrong equations are given intentionally, 'because the right ones would be too complicated.' This seems to be rather unscientific treatment.

As for the actual subject-matter, both the special reaction and the systematic methods of Qualitative Analysis appear to be admirably chosen. Is it not time, however, that schemes for complete analysis should consider the possible presence of elements so frequently met with in natural and artificial products as are titanium, lithium, uranium and tungsten? It is also peculiar that, while the rarer elements are dismissed in the Qualitative Analysis, with a few paragraphs describing their most characteristic special reactions, these same paragraphs contain detailed instructions for their purification and quantitative determination!

The quantitative analysis of the common elements is treated in the last two hundred pages in an admirable manner, the separations especially receiving adequate consideration. But it seems queer to read of certain methods as recently discovered, which have been in use ten or fifteen years; while the author appears to be quite unfamiliar, for instance, with the Gooch Crucible, whose use has removed so many obstacles from the analyst's path.

The translation is not done very skillfully—it is unidiomatic, and in many passages two or three readings are required before the author's sense can be accurately ascertained.

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A Treatise on Civil Engineering. By W. M. Patton. New York, John Wiley & Sons. 1895. Octavo, pp. xviii, 1654. Price, $7.50.

Fifty years ago it was easy to compress the science and art of civil engineering into a single volume; to-day it is an impossibility. Civil, as distinguished from military, engineering is scarcely a century old, but its growth has been so vigorous, and the branches of its activity are so numerous, that the term is becoming somewhat vague. Telford's definition—the art that utilizes the materials and forces of nature for the benefit of man—was a good one in 1818, but it now can only be applied to the whole field of construction which is now subdivided into civil, mechanical, mining and electrical engineering.

The best definition that can now be given is perhaps the following: Civil engineering is the science and art of economic construction undertaken for the purpose of facilitating the transportation of men and matter. It thus embraces roads, railroads and canals, upon which men and freight are transported, together with river and harbor improvements; irrigation, water and sewerage systems for the transportation of water and sewage; and all the necessary foundations, bridges and structures for these objects. It includes all the surveys, estimates and mechanical principles required to build and maintain such construction in the most

economic manner consistent with the proper degree of security. The wonderful progress of the nineteenth century has, however, caused civil engineering to become divided in practice into special departments like railroad engineering, bridge engineering, irrigation engineering and sanitary engineering.

Mr. Patton's treatise, when tested by the above definition, is found to be defective; at the same time it is better and more comprehensive than would be expected when the vast range of the subject is considered. It includes fifty-nine chapters, together with an appendix of 125 pages. Many chapters contain information that can be found in no other single volume, clearly presented, well illustrated, and often set forth with the weight of authority that can attach only to the writings of an engineer who has long been in responsible charge of important construction work. Other chapters are compiled from standard treatises on special subjects, or from periodical literature. Throughout care and thoroughness are apparent, and a volume has been produced which is likely to be of much value to the younger members of the engineering profession.

Strictly speaking, the book is not a treatise, but its character is cyclopædic. A treatise is a classified and logical presentation in which causes precede their effects. Above all works on civil engineering, Rankine's manual stands highest as a treatise, for its theory is set forth in most logical relation to practice. Rankine's theory, though often difficult for students, is his own, and carefully coördinated on a uniform plan. Mr. Patton's method is one more suitable for a cyclopædia than a treatise, as his theoretic discussions have been largely adopted from other authors and have little coördination. For instance, the theory of earth pressure is taken from one author, the theory of trusses from another, and the theory of elastic arches from a third. This has not been done without due credit, but in a treatise all these should have been worked out on a uniform basis and with systematic classification. Some investigations are also left more or less incomplete, with references to books where thorough discussions may be found. Such methods detract from the logical completeness that a true treatise should possess.

In one respect Mr. Patton has improved on the method of Rankine. Numerical examples are given illustrating the application of the theory. This is absolutely necessary for students and for most engineers, as algebra is always hazy, and mechanical principles are rarely well understood until they are applied to concrete problems. These examples are well selected to illustrate engineering practice, and they are usually worked out in a complete manner.

The most valuable and authoritative chapters are those relating to construction work, including earthwork, masonry, foundations, arches, dams, tunnels and river and harbor improvements. Numerous detailed descriptions of important works are presented to illustrate the best modern practice. The subject of the materials of engineering is set forth, not exhaustively, but clearly and well. As a cyclopædia of construction work the book may properly be called one of high rank.

The theory of bridges occupies much space, but it does not appear that the discussions contain any material improvements over the authorities whose methods have been mainly followed, unless it be in numerical illustrations. On hydraulic and sanitary engineering the book is weak. A few hydraulic formulas of value are given, but several long since discarded are also stated, and the elaborate determinations of hydraulic coefficients made in recent years are quite unnoticed. The separate system of sewerage is not mentioned, and little is

given relating to water works. These omissions show the defects of the author's system of classification, and demonstrate how impossible it is to write a satisfactory one-volume treatise on civil engineering at the present day. A comprehensive treatise, like the *Handbuch der Ingenieurwissenschaften*, must consist of many volumes and be the work of many men.

MANSFIELD MERRIMAN.

LEHIGH UNIVERSITY, July 29, 1895.

Electricity Up to Date for Light, Power and Traction. JOHN B. VERITY. London and New York, Frederick Warne & Co. 1894.

The preface of this book tells us that 15,000 copies have found their way into circulation. The title is a misnomer, unless the date is mentioned. In these days of active investigation and rapid application of discovered principles a book on electricity is out of date as it drops from the press. This statement is exemplified in this publication. The recent lucid investigations of Mr. R. E. Crompton on electric heating do not appear, and the surprising results of Mrs. Ayrton on the electric arc receive no mention. The various prime movers are mentioned, excepting the steam turbine, which, perhaps, is the most promising of all motors. The author ignores pretty generally what America is doing in the electric field, except in the case of Edison, to whom he gives credit for what was known before Edison was born—'the subdivision of the electric light.'

One of the first and certainly one of the simplest arc lamps, and the one most used, the Brush, receives no mention. There are several expressions which ought to be omitted from popular books, to prevent the spreading of erroneous ideas. Among these are 'Storage of Electricity,' used in this book as the head of a chapter; 'Electric Pressure,' for 'Difference of Potential.' The confounding of these terms causes great confusion in the schools. We expect better things in a book which professes to be both scientific and popular. On page 184 is the statement that in a wire through which a current of electricity is passing 'the heat generated is proportional to the quantity of current used;' it would have been just as easy to have stated the exact law. The book is well printed and illustrated, but it is difficult to treat so large a subject in 200 pages with success. J. W. MOORE.

LAFAYETTE COLLEGE.

Neudrucke von Schriften und Karten über Meteorologie und Erdmagnetismus herausgegeben von Professor Dr. G. Hellmann, No. 4. E. HALLEY, W. WHISTON, J. C. WILCKE, A. VON HUMBOLDT, C. HANSTEEN. *Die ältesten Karten der Isogonen, Isoklinen, Isodynamen; 1701, 1721, 1768, 1804, 1825, 1826.* Berlin, A. Ascher & Co. 1895. Sieben Karten in Lichtdruck mit einer Einleitung. 26 pp., 4to.

The above forms No. 4 of the very interesting series of reprints in facsimile of epoch-making rare old books or charts in Meteorology and Terrestrial Magnetism edited by the well-known meteorologist and bibliographer, Professor Hellmann, of Berlin.

Like its predecessors,* the number before us commends itself by its keen, critical and thorough research, by its beautiful typographical execution and by the lowness of the price. Hardly one of the seven charts given could be obtained for the price (5 marks) asked for the whole. It is needless to remark that the editor of these successful reprints and his coöperators, the German Meteorological Society and its Berlin Branch, have thus merited the warmest

* No. 1. L. Reynman: Wetterbüchlein. Von wahrer Erkenntniss des Wetters. 1510.

No. 2. Blaise Pascal: Récit de la Grande Expérience de l'Equilibre des Liqueurs. Paris, 1648.

No. 3. Luke Howard: On the modifications of clouds. London, 1803.