the class to whom it was addressed. The traditions of the volume have been well supported by Mr. Llewellyn Preece, Sir William's son. While many of the original illustrations have been preserved and reproduced in the new edition, more than a hundred new illustrations have been incorporated.

It is so rarely that we find a man's scientific and literary production adequately brought up to date by the labor of his son, that the book before us would have a claim for recognition on this account alone.

In view of so much new material which has been introduced, it seems invidious to complain of omissions. It is to be regretted, however, that the last chapter of the original edition, devoted to "Commercial Telegraphy" and dealing with the very interesting and special administrative features of the British telegraphs, should have had to disappear, in making up the new volume. There was a characteristic quality in that presentation which we think will be missed in the new edition, and which is valuable to students of telegraphy.

The new chapters on Repeaters, Quadruplex, Multiplex, the Telephone and Wireless Telegraphy are excellent, and the treatment which they offer of those subjects accords remarkably well with the style of the original volume.

A. E. KENNELLY

A History of Japanese Mathematics. By DAVID EUGENE SMITH and YOSHIO MIKAMI. The Open Court Publishing Company, Chicago, 1914. Pp. vii + 288.

This interesting story of Japanese mathematics is presented in most attractive garb. The paper, the type and the illustrations make of it a work which it is a delight to handle, but an American must feel some regret that this beautiful book with the imprint of an American publishing house is nevertheless from the press of a German printer, W. Drugulin, Leipzig.

The Japanese mathematics is largely indigenous and, as the authors well state, it is "like her art, exquisite rather than grand." Of the six periods into which the history of their mathematics may be divided the first extends to 552 A.D., and is almost entirely a native development. The second period, from 552 to 1600, was characterized by the predominance of Chinese mathematics. The third period was a kind of renaissance which reached its highest development in Seki Kowa (1642–1708), the most famous Japanese mathematician. The fourth and fifth periods, from 1675 to 1775 and from 1775 to 1868, are marked by the development of the *wasan,* or native mathematics. Even before these periods the Jesuits had secured a foothold in China, and a Japanese student of mathematics was working under Van Schooten in Leyden as early as 1661, so that some influence of European mathematics may be confidently assumed. The sixth period is the period of the present day which, in mathematics, at least, knows nothing of political and racial boundaries.

The uncertainty of the first and second periods is best illustrated by the fact that but 17 pages are devoted to their consideration. A passage in the discussion of the Chinese "Arithmetical Rules in Nine Sections" is also significant: "If these problems were in the original text, and that text has the antiquity usually assigned to it, concerning neither of which we are at all certain, then they contain the oldest known quadratic equation."

Tangible arithmetic seems to have secured its greatest development among the Japanese. The fundamental operations with the *soroban,* a modification of the Chinese *swan-pan,* are explained in a detailed manner, and illustrated with excellent photographs. Certainly it is striking that in Chinese *swan-pan* has the meaning "reckoning table," which corresponds precisely to the Greek word from which "abacus" is derived, this also having the meaning "table," particularly for bankers. The *sangi,* or computing rods, are explained both as used for representing numbers and also as applied to the solution of algebraic equations.

Extensive numerical computation appealed greatly to the Japanese as well as to the Chinese mathematician. The game side of mathematics is represented by magic squares, and even magic circles. An approach to the methods of the calculus is found in the *yenri,* or circle principle, which tradition states was devised by Seki Kowa.

This work should appeal to a wide circle of readers, to the students of the history of science, to all interested in Japanese civilization and even to the general reader, for much of the work is non-technical. Certainly this book will contribute to a juster and broader appreciation of the Japanese genius.

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The Development of Mathematics in China and Japan; Abhandlungen zur Geschichte der mathematischen Wissenschaften, Vol. XXX. By Yoshio Mikami. Teubner, Leipzig, 1913. G. E. Stechert and Co., New York. Pp. x + 347.

The activity of Mr. Mikami in making the mathematics of China and Japan known to the western world is highly to be commended. Besides many articles dealing with particular problems of the history of mathematics, Mr. Mikami has an earlier work, "Mathematical Papers from the Far East," in the same series as this volume under discussion, and also another book jointly with Professor David Eugene Smith, "A History of Japanese Mathematics," published by The Open Court Publishing Company. The more active cooperation of some English-speaking historian of mathematics would have been desirable in the two volumes which were published in Germany. Professor G. B. Halsted has, indeed, prefatory notes in the volumes which imply that the task of correcting the English was entrusted to him, but the literary charm of Professor Halsted's own works is lacking here, and even unintelligible as well as non-idiomatic English mars the excellence of these works. Errors are too numerous to be listed.

The book is divided into two parts: the first 21 chapters discuss the Chinese mathematics, and the following 26 chapters the Japanese. Three chapters which are of great value to the student of the history of science are entitled, A General View of the Japanese Mathematics, A Chronology of the Japanese Mathematics, and A Short Notice of the Historical Studies of the Japanese Mathematics. Somewhat similar treatment of the Chinese portion would have added much to the value of the work. An omission in the bibliography of the historical works is Souciet (Père), *Observations mathématiques, astronomiques, etc., tirées des anciens livres Chinois, ou faites nouvellement aux Indes et a la Chine par les pères de la Comp. de Jesus* (Paris, 1729), to which my attention has been called by Professor W. W. Beman.

Considerable uncertainty attaches to the dating, and even the content, of the ancient Chinese and Japanese mathematical treatises, but this, we may say, seems somewhat characteristic of our knowledge of the early Orient, particularly India. An evidence of this uncertainty is the fact that Mikami's description of the early "Arithmetic in Nine Sections" is quite different (footnote, p. 10) from that given by T. Hayashi in his "Brief History of Japanese Mathematics" which appeared in the *Nieuw Archief,* Tweede Reeks, Deel VI. (not accessible to me).

To the student of mathematics the most striking feature of this history will doubtless be the processes of solution of equations of higher degree than the second, by means of the *sangis* or calculating pieces. These solutions require a great amount of detail and approach closely the methods of Horner and Newton. The attention paid to the "squaring of the circle" is of interest, and the approach to a determinant notation is truly striking. The student of the history of mathematics will doubtless be most impressed by the description of the early Chinese process of multiplication of an integer of several places by an integer of the same kind, for the process corresponds in many details to the methods taught in the early works on the Hindu art of reckoning.

Some allowance for the enthusiasm of a Japanese writer must be made by the reader. However, to compare the Japanese Seki with Newton, "If Seki did not surpass Newton in his achievements, yet he was no inferior of the two," is quite beyond the bounds of allowable enthusiasm, for no evidence is presented