

bamboo cellulose, mostly because the work had been carried out empirically, without the scientific assistance of the chemist, and it is largely owing to the systematic work of Mr. Raitt that these difficulties have been overcome.

For twenty-five years, in part assisted by the Government of India, Mr. Raitt has made an exhaustive and scientific study of the subject, with the result that the problem of the utilisation of the bamboo has been largely solved. Culms of all ages, including the nodes, can be digested, mixed together, with a soda consumption of 16 per cent on the weight of bamboo, and a bleaching powder use of 8 per cent on the pulp at a pressure of 30 lb. of steam, the process only taking 5 hours. A yield of 45 per cent of unbleached and 42 per cent of bleached pulp is obtained by this process.

The book under review is a complete epitome of the subject based on Mr. Raitt's own practical experience; it deals with the analysis, the digestion in the autoclave, and all the practical problems arising out of the treatment in large scale operations, and contains an attractive account of the occurrence and growth of the bamboo. A section devoted to the microscopic features is illustrated with twenty plates.

The world's total standing crop of bamboo is enormous. In Burma alone an annual crop of 150 million tons is talked of, much of which could be easily exploited commercially, so that if suitable pulp really can be made from it, a supply which is inexhaustible can be obtained from materials which have no value for any other purpose.

E. F. ARMSTRONG.

The Teaching of Mathematics.

Craftsmanship in the Teaching of Elementary Mathematics. By F. W. Westaway. Pp. xvi + 665. (London and Glasgow: Blackie and Son, Ltd., 1931.) 15s. net.

SOME four hundred pages of this book are given to the elementary parts of mathematics, from the first four rules of arithmetic up to the standard of a school certificate. The treatment is varied, but often takes the form of outlined specimen lessons; it is full of useful hints about the details of teaching, and is sure to be welcomed by a large body of teachers.

Mr. Westaway's attitude is that of a moderate reformer. He is very far from wishing to impose stereotyped methods on teachers: so much so that sometimes a piece of good advice is given with

insufficient emphasis—for example, "it is doubtful if the term infinity ought to be used below the Sixth". What he cannot abide is the slavish adoption of doubtful forms of traditional procedure. His standard of what a boy ought to know is very high; we read, for example, that fourth form boys are prone to forget the factors of $a^4 + a^2b^2 + b^4$. The excursions into logic are not very successful, though there will be general agreement with what is said about its restricted place in elementary teaching.

In spite of such blemishes, the book will undoubtedly be of great value to the inexperienced teacher; and not to him alone, for there is much that will be helpful to the master responsible for organisation. The importance of the teaching of the lowest sets is insisted upon, and there are useful suggestions about the non-specialists in the sixth form. There are interesting chapters on wave motion, map projections, and statistics, and some shorter ones on subjects like astronomy and optics; these will serve to remind the organiser of some topics that are often neglected.

Mr. Westaway's experience of the teaching of mathematical specialists would seem to have been unfortunate. He has sometimes been "almost bored to tears . . . with the petrifying stuff doled out . . . which is virtually the same as forty years ago". The development of calculus teaching with its applications to mechanics, the improvements in analytical methods and the freer use of projective methods in geometry, and the mitigation of 'identity' work in algebra and trigonometry, are a few indications that specialist teaching is not, as Mr. Westaway seems to think, being stabilised at the level of 1890.

Thus it may be expected that the specialist part of the book will be less valuable than the other. There are, it is true, still useful hints to be found, but the material and treatment smack of the nineteenth century rather than of the twentieth. For example, the "principle of continuity" is quoted from a textbook that appeared in 1893, and although we are told that pupils must understand the notion of a limit, we find, elsewhere, the archaism "when Q coalesces with P , the angle becomes a right angle". Again, the Argand treatment of complex numbers is prefaced by the reactionary proposal to "define the symbol $\sqrt{-1}$ as an expression whose square is -1 ".

Many references to other books are given, and there is an interesting questionnaire for young teachers which will tax the powers of many of their seniors.