

As might be expected, the chapter on stereometry is mainly interesting for the account it gives of Archimedes's great discoveries. The brief section on analytical geometry shows how Fermat really invented the method independently of Descartes. Parent appears to have been the first to publish a treatise on analytical solid geometry; this was nearly seventy years after the appearance of Descartes's "*Géométrie*."

The only other important section of the book is that on conic sections. It cannot be considered so good as some of the others; it does not deal with projective properties at all, and thus does injustice even to Apollonius, to whom, rightly enough, a great part of the thirty-six pages is devoted.

To profit by this history no advanced knowledge of mathematics is necessary; and it is to be hoped that the author's labours will be rewarded by the appreciation of many readers.

G. B. M.

THE PRACTICAL METHODS OF FRACTIONAL DISTILLATION.

Fractional Distillation. By Prof. S. Young, F.R.S. Pp. xii+284. (London: Macmillan and Co., Ltd., 1903.) Price 8s. 6d.

IN his preface Prof. Young says that he wrote this book in the hope that the solution of the difficulties of fractional distillation might be rendered easier. He has written an eminently practical treatise on the subject and one that cannot fail to be of considerable value.

After an introductory chapter describing the necessary apparatus and the methods of carrying out a distillation process, the vapour pressures and boiling points of liquids are first dealt with. Very little is known of the connection between the vapour pressure and composition of a mixture of two or more perfectly miscible liquids. The simple formula for the vapour pressure of a mixture of two perfectly miscible liquids A and B,

$$P = \frac{mP_A + (100 - m)P_B}{100},$$

where P_A and P_B are the two partial pressures and m the molecular percentage of the compound A, is only strictly applicable when the two components are closely related in chemical composition, when they have the same critical pressures and when the attraction between the unlike molecules is equal to the geometric mean of the attractions between the like molecules. In certain other cases the deviations from the theoretical values are not large, but in the majority of cases the formula gives no approximation to the truth. Is it not possible that the deviations are due to the surface layer having a different composition from that of the bulk of the liquid, as is known to be the case with mixtures of certain alcohols and water?

In the chapter dealing with the boiling points of mixtures the cases of binary and ternary mixtures of minimum and of maximum boiling point are fully treated. There follows next an account of the constitution of the vapour and liquid phases, including the work of Brown, Leffeldt and Carveth; Brown found that in certain cases with two components the ratio of the masses of the two in the vapour phase was equal to

their ratio in the liquid phase multiplied by a constant, while Leffeldt showed that the logarithms of the ratio in the vapour phase were a linear function of the logarithms of the ratio in the liquid. In another chapter the theoretical considerations worked out by Duhem, Margules and Zawidski are briefly given.

The next section deals with the methods of carrying out fractional distillations of simple and complex mixtures, and also with the various forms of still heads which have been devised at various times. This is undoubtedly the most valuable portion of the book, inasmuch as it is drawn almost entirely from Prof. Young's own work. The methods of fractional distillation are described in detail, great stress being rightly laid upon the graphical expression of results. This may be done most easily by weighing the distillate obtained at various temperatures and plotting the values of dW/dT thus obtained against the temperature; it is in this way only that the distillation of a complex mixture can be properly carried out, for components present in only small quantities may otherwise easily be overlooked. Many forms of still head are described, amongst which the most efficient have been designed by Prof. Young himself. Tables are given of the relative efficiency of the various designs, as shown by the results obtained with mixtures of benzene and toluene, and of other substances. A chapter follows here containing descriptions of the various forms of still heads used in manufacturing processes.

The remainder of the book deals in the main with the application of the methods previously described to certain problems, as, for example, the quantitative analysis of a mixture of liquids and the separation of the components of a constant boiling mixture. Amongst the latter examples occurs the interesting case of the removal of the last traces of water from alcohol by distillation after the addition of a small quantity of benzene. If the correct quantity of benzene has been added then there distils over the ternary benzene-alcohol-water mixture, leaving pure alcohol in the still. It is safer to add a slight excess of benzene, and in this case, after all the ternary mixture has come over, the remainder of the benzene distils as the binary benzene-alcohol mixture, leaving again the pure alcohol.

It is impossible to touch upon all the points of interest in this book. Its chief value lies in the fact that many examples are given of the various processes, mostly from Prof. Young's own work. Moreover, a considerable amount of hitherto unpublished matter is incorporated. Our thanks are due to the author for so useful a work.

E. C. C. B.

A FRENCH MANUAL OF FORESTRY.

Traité de Sylviculture. Exploitation et Aménagement des Bois. By Prof. P. Mouillefert. Pp. 476. (Paris: Félix Alcan, 1904.) Price 6 francs.

THIS is the second volume of a manual of forestry the first of which was noticed in *NATURE* of March 26, 1903. The present volume treats of the utilisation and management of woodlands, 361 pages being de-