

a knowledge of pure chemistry this treatise will prove an efficient guide to one of the most complicated and technical branches of applied chemistry.

The introductory chapters deal with the history of synthetic dyes and the nature of coal tar. It is of interest to note how remarkably the nature of tar varies with the temperature at which coal is distilled. When produced at 400–500° C. the tar is rich in volatile hydrocarbons, especially paraffins, and is valueless for the colour maker. At 900–1000° C. an optimum yield of aromatic (benzenoid) compounds is obtained. Tar produced at the higher temperatures contains, roughly, the following percentage amounts of important direct coal-tar products:—Benzene, 2; toluene, 0.5; phenol, 0.6; naphthalene, 5–6; and anthracene, 0.6. It is on these five substances, together with two or three others obtained in even smaller proportions, that the great synthetic colour industry is based.

Ten chapters are devoted to an explanation of the chemical processes whereby the foregoing direct coal-tar products are converted into intermediate products, or "intermediates." Sufficient theoretical matter is introduced into this section to make the practical details readable and connected. For example, the constitutions of quinones and diazo-compounds are treated fully because of their bearing on the structure of organic dyes.

The chapter on the application of dyes refers to the dyer's classification of colouring matters into acid, basic, mordant, direct cotton, vat, or sulphide dyes. Concrete examples are given of each of these groups of dyes with appropriate methods of applying the colouring matters to the textile fibres.

A chapter on the colour and constitution of dyes and coloured substances is followed by eleven chapters devoted to the synthetic dyes classified under their respective chromophores or characteristic colour-bearing groups.

One of the most informing of these sections is the chapter on vat dyes. In this group we find the oldest and newest colouring matters known to dyers. Indigo and Tyrian purple were used by the ancients, whereas the other indigoid dyes and the anthraquinone vat and sulphurised vat dyes have all been discovered since the commencement of the twentieth century.

The last chapter describes the principal natural dyes, a group of colouring matters which has during the war regained a certain amount of its former importance owing to the shortage of synthetic dyes.

The authors are fully alive to the national importance of establishing a British sphere of influence in dyes, and as an outward and visible sign of this sentiment perhaps they might be persuaded to drop the inelegant expression "dye-stuffs," obviously a literal translation of "Farbstoffe," in favour of such English terms as dyes, colouring matters, and dyewares.

G. T. MORGAN.

LUIGI CREMONA.

Opere Matematiche. Di Luigi Cremona. Tomo Terzo. Pp. xxii+520. (Milano: Ulrico Hoepli, 1917.) Price Lire 30.

THIS final volume of Cremona's collected mathematical works contains thirty-six papers, including the treatise on the general theory of surfaces, the memoir on cubic surfaces, the tract on reciprocal figures in graphical statics, and various notes on birational transformations in space. Prefixed thereto is a biographical notice by Prof. E. Bertini, giving many interesting details of Cremona's career.

For many years Cremona was better known to English readers than were the majority of foreign mathematicians; and it is not difficult to give reasons for the fact. So far as the geometry of algebraic surfaces is concerned, he and Salmon were kindred spirits; and the latter gives numerous references, in his "Solid Geometry," to Cremona's investigations.

Then the Clarendon Press published two excellent English translations of his "Elements of Projective Geometry" and "Graphical Statics" at a time when interest in these subjects had been aroused by Henry Smith, Clerk Maxwell, and others. Finally, Cremona's cast of mind and style of composition could, and did, appeal successfully to English mathematical taste.

Perhaps Cremona's greatest achievements were due to his superb qualities as a teacher and educationist. Though he lived until June 10, 1903, the last of his mathematical papers appeared in Proc. L.M.S. for 1884; and the reason was that the Italian Government, recognising his value, appointed him to posts of such importance as to absorb all his energies. This is not the place to estimate his services to the Italian system of education; but they were undoubtedly very great, especially in such things as the courses given in engineering.

Cremona's ultimate rank as an original mathematician will probably rest mainly on his discoveries in the algebraical theory of birational transformations; and it is not without justice that the term "Cremona transformations" has been adopted for the simplest class of them. As developed by Nöther and others, this theory is of cardinal importance, both in analytical geometry and in the theory of Abelian functions; and we may fairly say that Cremona was the first to demonstrate its value and give brilliant and original applications of it. As an exponent of novel and comprehensive theories he displays qualities of the very highest order. G. B. M.

OUR BOOKSHELF.

Scientific Treatise on Smoke Abatement. By H. Hamilton. Pp. xiii+155. (Manchester: Sherratt and Hughes, 1917.) Price 5s. net.

It is a little unfortunate that the term "scientific" should have been included in the title of this book, seeing that the author is clearly more familiar with the subject of mechanical engineering