cially connected, facts, it ceases to be a subject worthy the serious attention of educated men. One turns to a new book on elementary chemistry, hoping to find at least an attempt to rescue chemistry from the overwhelming burden of so-called facts, beneath which the science is in danger of being buried. In this case I confess to disappointment. It may be replied that the chemistry which is not clearly apparent in the purely descriptive parts of the book is to be found in the "introductory outlines" wherein the "fundamental principles and theories" of the science are stated. I admit at once that there is much excellent matter in these earlier chapters; but I do not find there a connected setting forth of elementary principles, as arising from facts, and binding facts into some kind of harmonious whole. There is not much either exact or imaginative treatment; and these two I take to be the notes of genuine science.

The perusal of this book produces in one's mind a strange feeling of inversion; many things seem to be standing on their heads. The reader feels that a rapid mental rotation, to right or left, is demanded. Change is very properly said to be the feature of all chemical occurrences; but at a very early stage (p. 5), after two pages have been occupied in lightly touching the subject of the constitution of matter, the student is told that "Any change which arises from an alteration in the structure of the molecule is a chemical change." This is an example of the topsy-turviness of parts of the book. The statement quoted has a meaning when the meaning of such a very symbolical expression as "structure of the molecule" has been adequately grasped. At this stage of progress the student cannot have any clear image called up in his mind by the words I have quoted; they must be merely words to him. But he might have grasped the prominent and characteristic features of chemical change had these been put before him by well-chosen experiments. Another instance, to my thinking a glaring instance, of putting theory where facts should come, and facts where theory, is found in chapter ii., which deals with elements and compounds. The distinction between these classes of substances is stated at once, and is stated only, in the language of atoms and molecules.

"In the substance sulphur, all the atoms composing the molecules are alike; while in water . . . there are two distinct kinds of atoms in the molecule. Matter, therefore, is divided into two classes, according as to whether its molecules are composed of similar or of dissimilar atoms. Molecules consisting of atoms of the same kind are termed *elementary molecules*, and substances whose molecules are so constituted are known as elements."

The chapter which deals, and deals in a clear and most praiseworthy style, with the laws of chemical combination, is headed "The Atomic Theory." I think the author must have taken his own words too literally (p. 29):

"Dalton embraced the ancient doctrine of atoms, and extended it into the scientific theory which is to-day known as Dalton's atomic theory, and is accepted as a *fundamental creed* by modern chemists." (The italics are mine.)

A "scientific theory" and a "fundamental creed" are very different things.

For his descriptive treatment of the materials from which chemistry is built up, I think the author is to be praised; but I do not think he has succeeded in setting forth the principles of the science of chemistry clearly, adequately, or in fitting order.

M. M. PATTISON MUIR.

OUR BOOK SHELF.

Astronomia Sferica. An Elementary Treatise. By Francesco Porro. (Roma: Società Editrice Dante Alighieri, 1894.)

IN these 160 pages, the author has endeavoured with success to bring before his readers, in as simple a way as is consistent with the subject, the elements of spherical astronomy. With the exception of a small knowledge of the rudiments of the differential calculus, the mathematical ability is by no means taxed. The order in which the subject-matter has been arranged, and the field which is covered, can be gathered from the following short summary. After dealing first with the sphere generally, and the form and daily motion of the earth, the annual motion round the sun, and the methods of the transformation of coordinates, the measurement of time is next explained, in which Kepler's equation, the equation of time, and the transformation of mean into sidereal time, and *vice versâ*, are discussed. Then follows a chapter in which the movements of the moon are clearly expounded.

Diurnal parallax and refraction, the variations of the fundamental planes, aberration and annual parallax, form the subjects for the next three chapters; while the remaining ones are devoted to the determination of the positions of stars and their proper motion, and to the solar system in general. In the last-named, the apparent movements of the planets, the theories of Copernicus and Kepler, the necessary data for the determination of planets' orbits, &c., are touched upon.

From the above it will be seen that the most necessary points for the student have been dealt with, but they have not been treated at too great a length. As an introduction to higher works, this book will be found most useful; but its use in this country will be to a great extent restricted, owing to it being printed in Italian.

The New Technical Educator. Vol. iv. (London, Paris, and Melbourne: Cassell and Co., 1894.)

THE previous volumes of this work have been duly noted in our pages. Volume iv. is in every way up to their standard of excellence.

The subject of the manufacture of iron and steel occupies the first part of the volume. The author of this seems to be well acquainted with the practical details. We note that he appears to consider that the presence of but 0·05 per cent. of sulphur in steel is more or less harmful, producing a metal sensibly red-short. This may be the case; but it is generally considered that the percentages of phosphorus, sulphur, or silicon must not each exceed 0·06 per cent., and then their effects may be overlooked in axles, tyres, plates, &c. Engine-tyres are said to give a tensile test of 46 tons per square inch, with a minimum elongation of 20 per cent. in a 3-inch length. These results are rather extreme, with a sectional area of ½ square inch of test-piece. If the extension exceeds 16 per cent. the result may be considered good with this tonnage.

As in previous volumes, we find much interesting information on cutting tools, from the pen of Prof. R. H. Smith, dealing principally with lathes, drills, and punching and shearing machinery. Different metal shavings are illustrated from photographs, and clearly show the nature of the different metals. The steel shavings shown,