principal points, we can find geometrically the position of the image of any point after refraction through the surface. This we may describe as the geometrical treatment of the subject.

By the aid of analysis we can show that there is, to the degree of approximation to which we go, a point image of any point, and we can find in terms of known quantities the positions of the cardinal points of the system and the relation between a point and its conjugate focus. Mr. Pendlebury adopts both methods indiscriminately; it seems to us that it would have been better to have kept the two somewhat more distinct.

A short account of the paper of Maxwell to which reference has been made, "On the General Laws of Optical Instruments," would form a valuable addition to the book, and may, perhaps, be included when the author extends it, as he hopes to do, so as to cover a wider area in the field of geometrical optics. At present the field is open to him, and a book on the whole subject as good and interesting as "Lenses and Systems of Lenses" is greatly needed.

R. T. G.

OUR BOOK SHELF

Fuel and Water. Translated from the German of Franz Schwackhöfer, by Walter R. Browne, M.A. (London: Charles Griffin and Co., 1884.)

MR. WALTER R. BROWNE has made a very good translation of a book written for the German students of agriculture in Vienna. He has added a clever sketch of the mechanical theory of heat as an introduction. The English of the translation is remarkably good and clear, and the original treatise has been written by a competent man. The translator in his preface appeals to manufacturers and users of steam on a large scale; but the work is much too scientific for them, dealing not with the various forms of boiler now in the market, but rather with the general principles on which boilers should be constructed. On the other hand I fear that the information given is in many parts not full enough for the engineer, and we frequently find data given such as will be of more value to the German than to the English reader. The chief physical formulæ relating to heat and applicable to practical questions connected with engineering are clearly stated, but the comparison of results deduced from these formulæ with the results derived from actual experience is rather sparingly made. The third chapter, which is headed "Heating Apparatus," treats of the furnace and its management. The author gives the results of some actual experiments as to the loss of heat in the chimney, in the ash-pits, in priming water, and by conduction and radiation. He also gives an experiment with what is called an economiser. This chapter seems to me one of the best in the book. Altogether, I think the work is one which may in many parts be profitably consulted by those engineers who desire to compare theory with practice.

FLEEMING JENKIN

The Elements of Euclid. Books I. to VI. With Deductions, Appendices, and Historical Notes. By J. S. Mackay, M.A. (London: W. and R. Chambers, 1884.)

THIS text-book has been compiled at the request of the publishers, and the event shows that it was by a "happy thought" their choice of an editor fell upon Mr. Mackay, the Mathematical Master of the Edinburgh Academy. Of it we have nothing to say but what is good. This praise is not so much for the text, for others have done well in this direction. Still even here Mr. Mackay has shown great judgment and skill in his selection of proofs. The text is in the main that of R. Simson's well-known

editions, and no change has been made in Euclid's sequence of propositions, and no violent change in his modes of proof.

But what we particularly like are the carefully prepared historical notes, which take the form of footnotes or of fuller paragraphs in the six appendices. Mr. Mackay remarks, "It would perhaps be well if such notes were more frequently to be found in mathematical text books: the names of those who have extended the boundaries, or successfully cultivated any part of the domain, of science, should not be unknown to those who inherit the results of their labour."

We regret that though authors have before expressed themselves to similar effect, yet few have had the inclination or leisure to act as our present author. He has had to curtail his material, but what he gives us shows that he is well qualified by the extent of his reading to satisfy this want.

We note here that recent French mathematicians are in the habit of attributing the first use of the word "orthocentre" (which Mr. Mackay ascribes to Dr. W. H. Besant) to Dr. Booth; in so doing they are certainly in error, as Dr. Booth himself, in the second volume of his "New Geometrical Methods" (p. 261), says "the point has been called by some geometers the *orthocentre*." What he may lay claim to is his calling what is now often called the *pedal triangle* the *orthocentric triangle*.

The figures are admirably drawn and are quite a feature of the book; they deserve the editor's commendation when he thanks Mr. Pairman for the "excellence of the diagrams."

This edition is well suited for the geometrical student, and, at the same time, its cheapness puts it within the reach of all who wish to study "Euclid."

Traité Pratique d'Analyses chimiques et d'Essais industriels. Par Raoul Jagnaux. (Paris: Octave Doin, 1884.)

THE purpose and character of this little book is best indicated by the saying of Berzelius which heads the author's preface: "Le meilleur mode d'analyse est celui qui exige le moins d'habitude chez l'opérateur." The book is mainly intended for the use of the chemical engineer and the metallurgist, and the methods of analysis described are essentially "works-methods," in which rapidity of execution is a very important consideration. Many of these methods are new, and have been devised partly by M. Hautefeuille, and partly by the author. We would especially note those depending upon the precipitation of such metals as zinc, copper, nickel, and bismuth as oxalates, whereby the formation of gelatinous precipitates, difficult to wash, is avoided. The book contains a large number of analytical results as evidence of the validity of the methods employed; many of these analyses, such as those of aventurine glass, garnierite, sylverine, are valuable as illustrating the composition of substances which are not frequently examined.

T.

LETTERS TO THE EDITOR

- [The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, or to correspond with the writers of, rejected manuscripts. No notice is taken of anonymous communications.]
- [The Editor urgently requests correspondents to keep their letters as short as possible. The pressure on his space is so great that it is impossible otherwise to insure the appearance even of communications containing interesting and novel facts.]

The Relation between the B.A. Unit and the Legal Ohm of the Paris Congress

AT a meeting of the Electrical Standards Committee of the British Association held on Saturday, June 28, the following resolution was carried:—

"That for the purpose of issuing practical standards of elec-