

attention is example 18, p. 229. Here the analysis really solves the problem of finding when  $(a+1)(\beta+1)\dots(\lambda+1)$  is a maximum subject to the condition that  $a^\alpha b^\beta \dots l^\lambda = N$ ;  $a, b, \dots, l, N$  being given quantities. But the heading of the article is, "How must the prime factors of a number enter into it that it may have as many divisors as possible? (Waring)," a question from which we have vainly tried to extract any meaning whatever, and with which, in any case, Prof. Smith's analysis cannot have anything to do.

G. B. M.

### OUR BOOK SHELF.

*Die Optik der elektrischen Schwingungen.* (Experimental Investigations on Electro-magnetic Analogies of the most important Optical Phenomena.) By Prof. A. Righi. Translated into German, with additions by the author, by B. Dessau. Pp. xi + 267; with 40 illustrations and figures. (Leipzig: O. R. Reisland, 1898.)

THOSE to whom Prof. Righi's Italian edition of last year was not accessible, will welcome this German translation of his interesting book. The reproduction, by means of electro-magnetic waves, of some of the more complex optical phenomena, necessitates the use of an oscillator which gives out a series of waves that do not decrease too rapidly in intensity, and that are considerably shorter than those used by Hertz in his experiments.

Prof. Righi has carried on a number of investigations with such oscillators which emitted waves ranging upwards from 2.6 cms. in length, and the present volume is devoted for the most part to an account of this work.

The first part deals with a detailed account of the construction and use of his oscillators and resonators, and with the secondary waves due to the presence of the receiver and neighbouring bodies. These effects are studied first, in order that they may not lead to misinterpretations in the later results.

In the second part the electro-magnetic analogies of many optical phenomena are considered.

The working details of the experiments are given, and the difficulties attending them are pointed out, thus enabling one to reproduce the effects with the least amount of trouble.

Two investigations which have appeared since the publication of the Italian edition are then appended, and the last part of the book consists of mathematical additions on various topics connected with the subject in hand.

The book is written in an able manner, and conveys to the reader a clear idea of the properties of electrical waves, and Prof. Righi's method of manipulating them.

J. Z.

*Calculations in Hydraulic Engineering.* By T. Claxton Fidler, M.Inst.C.E., Professor of Engineering, University College, Dundee. Part i. Pp. xii + 155. (London: Longmans, Green, and Co., 1898.)

THIS is the first part of an extended treatise, and it discusses Fluid Pressure and the Calculation of its Effect in Engineering Structures. The treatment of the subject is refreshing and stimulating, by contrast with the arid methods of our scholastic text-books. The illustrations of the abstract theory are taken from actual problems on a large scale, which appeal to the engineering student, to whom this treatise is addressed. A striking novelty is the discussion in Chapters iv. and vi. of the buckling tendency in straight pipes under uniform fluid pressure. Although the material of the pipe carries no longitudinal thrust, the conditions of stability are exactly the same as in Euler's theory of the bending of a column. This paradoxical fact is discussed theoretically, and its experimental verification is described in an Appendix. Chapter v. is on Fluid Arches,

and shows how the pressure in a main, forming a tubular arch, can be used to assist the stability. We are reminded of Prof. Fitzgerald's suggestions of inflated structures and columns, and the pneumatic system of architecture, in which the strength is kept up by compressed air, pumped in at intervals as required, as in the tires of our bicycles. A short account of Prof. Fitzgerald's theory will be found in the recent edition of Perry's "Applied Mechanics." Chapters viii. and ix. treat of the equilibrium and stability and bending stresses of floating bodies, not from the point of view of the Naval Architect, but as required by the Civil Engineer in the design of pontoons, bridge-caissons, and gas-holders.

The diagrams are carefully drawn to represent some real actual construction, and the illustrative examples are worked out to their numerical conclusions, an essential part of the theory for the engineering student, although so completely ignored in our academic treatises. G.

*Birds of the British Isles.* By John Duncan. Pp. xvi + 448; illustrated. (London and Newcastle: Walter Scott, Ltd., 1898.)

THE excellent illustrations and brief descriptions of British birds published in the *Newcastle Weekly Chronicle* met with such a favourable reception, that the author has considered it advisable to reproduce them in book-form. And in their new guise they form a volume which can scarcely fail to be acceptable to readers with limited purses, since, while every species is figured, the published price of the work is only five shillings. Neither can it be said that the volume is "cheap and nasty"; the type being clear and good, and the illustrations for the most part of high merit. Perhaps, indeed, they lack the pictorial elegance of photogravures, but as good specimens of wood-engraving they leave little to be desired; and there are many reasons why that style of illustration should not disappear from works of natural history. In many respects Mr. Duncan appears to be a disciple of Bewick; and in the case of the cuckoo (p. 142) so closely has he followed his master that his figure is merely a reversed replica of the original cut, with some additional details of surroundings. Generally, however, the figures are original, and they are often in advance of those of Bewick.

Although brief, the descriptions appear sufficient to identify the species. In the introduction, by Mr. C. Dixon, criticism of the work from a literary standpoint is deprecated; but the author might have ascertained that the British Isles form part of the Palaearctic region (p. 191), and also that the word *palaos* contains four vowels. As a whole, the volume is a highly creditable and artistic production.

R. L.

*Railway "Block" Signalling.* By James Pigg, A.I.E.E. Pp. 387. (London: Biggs and Co.)

THIS account of the development and details of the "block" system of railway signalling brings together a large amount of interesting information upon a method of regulating railway traffic which has assisted very considerably in bringing about the present state of precision and safety in railway work. The system has been in use for about thirty years, and it now represents the most extensive of all the adaptations of electricity to railway work. Mr. Pigg describes clearly the principles of train signalling and the apparatus employed; he also includes in his work the codes, regulations, and rules relating to railway signals of various kinds. With regard to the lines along which developments will probably be made he remarks:—"Railway signalling appears to have now reached a stage at which some departure from the present methods seems probable. The lines upon which changes will be made will, in all probability, result in a greater degree of automatic control than obtains at present."

The volume is an instructive contribution to an important subject.