

ordinary design being weak to resist the torsional moments to which they are subject. The last chapters are devoted to the cost of machining and the factors which govern it, to the construction of the "characteristic" diagram for any given headstock, and the means of measuring from it the economic value of the design. In the last chapter, by way of illustration, the authors show the application of the torque-speed diagram, and the lathe characteristic to a series of selected lathes built by well-known makers.

The book will be indispensable to the lathe designer, and to the manufacturer who employs large numbers of these machine tools; it is an admirable example of the way in which scientific research in our engineering schools can be applied to advance and improve the great manufacturing industries of the country.

(2) This is a revised edition, in part re-written, of Prof. Church's well-known text-book on the mechanics of engineering. The book is divided into two sections, one dealing with the mechanics of solids, the other with the mechanics of fluids, and a separate index has been provided for each section; the first section is again divided into three parts: the first part treats of statics, the second kinetics, while the third and most important part, covering 320 pages, deals with the subject of the strength of materials.

The chief changes in the subject-matter in this edition are confined to certain chapters on the strength of materials, and to portions of the section treating of the mechanics of fluids. An important new chapter is that devoted to the flexure of reinforced concrete beams, a subject of much interest to engineers engaged in structural design; the author considers that for purposes of practical design it may be assumed that, as in homogeneous beams, cross-sections, plane before flexure, remain plane when the beam is slightly bent; this assumption is only valid if the modulus of elasticity of concrete is constant in value; this is not so, but, as the author points out, it does not vary much in value within the limits of stress to which such reinforced beams are subjected in good design work.

Other useful fresh matter is that contained in chapters xii. and xiii.; in the former the subject of the flexure of simple and continuous beams is treated from the geometrical standpoint; that is, algebraic relations are deduced from the known properties of certain geometrical figures; this leads to a very simple and available form of the three moments theorem; in the latter there is a concise and lucid discussion of the relations between stress and strain in thick cylinders. In the section of the book dealing with hydraulics, the chief additions are those describing new appliances, such, for example, as the Cippolletti or trapezoidal weir, the Venturi meter, and the differential manometer.

Text-books dealing with the mechanics of engineers are constantly being consulted by practical men, who wish to refresh their memory in regard to the theory of some particular problem which they meet with in their professional work, and for this purpose a very complete index is essential. In any further re-issue of this work, it would be a distinct improvement if the indices were made more thorough and complete.

(3) As in part i., this book is divided into two main sections, one dealing with the mechanism of the car, the other with its management, and, in addition, there is a brief general introduction on the subject of electricity. As the book is intended rather for users of cars than for builders, the description of the car mechanism has been written in such a way that any intelligent non-technical reader should have little difficulty in appreciating the important points to which attention must be paid in design, and as to which the buyer must also be able to satisfy himself before deciding to purchase an electric car. In dealing with the management of the car, the author describes two forms of brake suitable for the measurement of the power of the motor, but he does not describe the simpler rope brake, which is much more satisfactory for such tests than the Prony friction brake, especially if, instead of a rope, a thin, hollow, flat band of metal is used through which a constant stream of water can be circulated to absorb the heat generated by the friction.

Special attention has been given to the management of the battery, since success in driving an electric car depends so much upon the manner in which the battery is handled. In regard to the cost of running in London an electric car, fitted with pneumatic tyres, the author estimates that it will average with a good driver 2'92d. per car mile, the cost of the electric energy only amounting to 0'12d., wear and tear of tyres accounting for 1'5d., depreciation of battery for 1'2d., the other expenses amounting to 0'1d. The last chapter of the book is devoted to petrol-electric vehicles, that is, to vehicles which combine with the motor and controller equipment of an electric car a petrol engine and a dynamo driven by it to supply electricity to the motor; this system possesses certain important advantages, and is being applied with success to commercial vehicles and omnibuses.

As soon as the battery problem is solved, the electric car will, at any rate for town use, rule supreme—but we are a long way yet from solving that problem.

T. H. B.

#### BIOLOGY FOR TEACHERS.

*First Course in Biology.* Part i., Plant Biology. Pp. xxv+204, and 302 figures; Part ii., Animal Biology. Pp. 224, and 408 figures; Part iii., Human Biology. Pp. 164+x, and 132 figures. By L. H. Bailey and W. M. Coleman. (New York: The Macmillan Co.; London: Macmillan and Co., Ltd., 1908.) Price 7s. 6d.

THIS book hails from across the Atlantic, and aims at supplying a course of work intermediate between unorganised nature-study and the formal science of the more advanced courses. The general intention of the authors is:—

"To lay greater stress on the processes and adaptations of life as expressed in plants and animals and men, and to attach less importance to botany zoology and physiology as such."

It is certainly well that teachers should do their utmost to prevent that study of botany which leaves the student ignorant and indifferent to the plants

around him, or of that physiology which does not lead to healthy living. The book appears to be intended for teachers rather than for students; but it is not very conveniently arranged. A certain amount of information is given on each topic handled, but usually not enough for a teacher who has not already considerable knowledge of the subject; and a number of questions is asked, often in a style that is almost irritating: e.g. "Which senses are very acute? Why? Dull? Why?"

But apart from matters of taste in style, it would be better to separate the volleys of questions from the descriptive text. The unfortunate teacher attempting to get up his lesson has now to wade through dozens of unanswered queries in order to pick out from them a few morsels of information scattered here and there over many pages of text. On the other hand, the trained and experienced teacher will derive few, if any, new ideas as to method, though he will probably welcome the excellent coloured diagrams.

The plants and animals examined are for the most part those which find place in the elementary courses in vogue in this country; but there are, of course, frequent allusions to American species. Of the three parts contained in the volume we prefer that devoted to human biology. In this part, information and questions are kept distinct, and the standard is just what is wanted for instructing pupils in the healthy working of the human body and for emphasising the importance of cleanly and active habits.

The pages are not entirely free from error. Etymologists will be startled to learn from Mr. Bailey (p. 60, part i.) that "parenchyma=parent+chyma, or tissue." We are tempted to inquire what derivation he would invent for "prosenchyma," and would venture to recommend a study of the Greek prepositions. Similarly, we question whether "batrachia" can be rightly translated "twice breather"; certainly the word is not synonymous with amphibia (p. 127, part ii.). The statements on p. 172, part ii., concerning migration are inaccurate; nor is it correct to state that the ferments (or enzymes) present in the digestive juices are "vegetable substances" (p. 100, part iii.). The figure (219) on p. 116, part ii., is that of a lamprey, not of an eel as stated in the legend.

O. H. L.

#### OUR BOOK SHELF.

*Schlich's Manual of Forestry.* Vol. V., Forest Utilisation. By W. R. Fisher. Pp. xii+840. (London: Bradbury, Agnew and Co., Ltd., 1908.) Price 12s. net.

WITH the appearance of this edition the whole subject of forest utilisation is brought thoroughly up to date. Prof. Fisher has given to English readers an admirable translation of what may be recognised as the best work on the subject. The German edition is itself based on Gayer's "Forstbenutzung," which was for many years the standard work, but with the lapse of time a new up-to-date edition became necessary to bring the book into touch with modern experience and practice. The task of writing a new edition was undertaken by Prof. H. Mayr, a former pupil of Gayer, and at present

his successor in the chair of forest utilisation in the University of Munich.

The volume is divided into four parts. Part i. deals with the principal forest produce, wood, in relation to its harvesting, conversion, and disposal. Part ii. treats of minor forest produce, its properties, utilisation, value, and disposal. In part iii. is considered the utilisation and disposal of the minor produce from the soil of the forest, while in part iv. the utilisation of the components of the forest soil, such as stone, gravel, &c., is given, and at the end we have a very useful index.

The whole work is profusely illustrated, and in this edition the number of illustrations has been increased by 73, making a grand total of 402, together with 5 full-page plates.

Of the several volumes which constitute Schlich's "Manual of Forestry," this one is probably the most complete in the treatment of its subject. The various parts are divided into chapters, and these, again, into sections, each section containing a clear and concise account of the subject or operation with which it deals. The student as well as the practical forester will find this volume a regular mine of information. This work will be found equally useful in Britain, our colonies, and elsewhere, as it deals with forest utilisation in its broadest sense. In fact, the authors have made use of all the available research of the nineteenth century in bringing the work up to date. The German work naturally gives most prominence to German matter, although at the same time taking into consideration that of other countries. The translator has added to this, and based the work on a still broader foundation, in order that it may be applicable wherever the English language is spoken.

This volume is sure to be appreciated by a large number of forest-owners and foresters all the world over, and it can be confidently recommended as the best and most exhaustive work dealing with the important and world-wide industry of forest utilisation.

*Parallel Paths: a Study in Biology, Ethics, and Art.* By T. W. Rolleston. Pp. xv+299. (London: Duckworth and Co., 1908.) Price 5s. net.

THE author contributes this thoughtful book towards "the establishment of a spiritual view of the universe on a natural basis." He believes that there is more in life than chemical and physical forces. The "living machine" that we hear so much about "differs essentially from other machines in not being a machine at all, or anything in the least like one." In support of his vitalistic position, the author refers in a lucid way to the difficulty of giving any chemico-physical interpretations of development and adaptability. "The master-word is nature's will to live." He considers the Lamarckian position and abandons it, noting, for instance, that if bodily characteristics acquired by exercise were transmissible by inheritance, the new-born child of right-handed ancestry ought to show some appreciable preponderance in weight and size of the right over the left limb. But he is not satisfied with Weismann's explanation either, though he admires the brave attempt to steer between the Scylla of Lamarckism and the Charybdis of "metaphysics." All evolution theories assume the responsive powers of protoplasm. But what does it respond to? If, as Weismann says, "the response is only to differences in the amount of nutriment obtainable by the various determinants of the germ-cell, and has only a fortuitous connection with the results attained," then how can we interpret adaptations such as that of the fish, Anableps, with its bifocal eyes? Thus the author is led to "a directive