Review

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edges are represented by dotted lines"? Here is another startling sentence,—“Note that the distance between two parallel planes is the vertical distance between the elevations of the two planes.” It seems strange to find in Chapter III., after the fact has been continually assumed, an attempt to show that the projection of a straight line is a straight line, based upon Euclid's definition of a straight line. Problems XV. and XVI. of Chapter V. should be entirely re-written and figures 57 and 58 re-drawn; then, perhaps, there will be no need for the remarks about the difficulty to a beginner. The former problem is the determination of the angle between two given planes M and N . The two pairs of contours (0, 0) and (10, 10) determine two points r_0 and p_{10} on the line of section. No other point on this line is required, and through p_{10} a plane O should be drawn at right angles to the line r_0p_{10} ; then the angle required is the angle between the lines (O, M) and (O, N). In the printed figures there are two contours (10, 10) which should be marked (9, 9). These are unnecessary and misleading, and they cannot be drawn until the figure is completed. There is a curious mistake in figure 70, the worked-out solution for drawing a regular octahedron with two intersecting faces inclined at given angles to the $H.P.$ The dotted lines in the finished diagram show that the author is quite unconscious of the fact that he has constructed his solid *underneath* the two given planes. In fact, the dotted lines really represent those edges which are nearest to the eye of an observer looking down upon the $H.P.$ Of the two examples given of Isometric Projection, that of a regular octahedron is not calculated to exhibit the *utility* of the method.

There is, however, thoroughly sound and practical work in the book, and it seems a pity that Major Ward has not taken advantage of his opportunity of improving it.

First Stage Building Construction. By BRYSSON CUNNINGHAM, B.E. (University Tutorial Press, 1901.) 2s. Pp. viii. 240.

A capital little text-book on Building Construction for the use of beginners. It is not a mathematical book, but the author has, in a few instances, given a simple explanation of the theory on which the construction is based, thus introducing the reader to the nature of the stresses in the different members of a structure, without considering the magnitudes of such stresses. The book is clearly written and well illustrated.

Exercises in Graphic Statics. By G. F. Charnock, Assoc. M.Inst.C.E. (J. Halden & Co., 1900.) Part II. 52 sheets of diagrams with printed explanations.

Part II. of this work is devoted to the graphical treatment of stresses in beams, cantilevers, and girders, and, as in Part I., the examples are taken from actual practice. Much of the subject matter is, of course, of a technical character, but it includes a great deal that would be interesting to the student of mathematics. This is not a book to be placed in the hands of a beginner, for he is not likely to acquire a knowledge of sound principles from these pages, where the explanations are frequently obscure and bewildering. Take, for instance, the author's exposition on sheet 2 of various methods for determining the moment of resistance at a vertical section of a loaded horizontal beam of breadth b inches and depth d inches. Denoting the stress per square inch at the extreme fibre of the section by S , he indicates how the moment of resistance M for the whole section may be determined by adding together the moments of resistance for the various horizontal layers. He abandons this method without making the summation, and suggests that the process may be simplified by “taking the mean or resultant stress per square inch on the various layers, which of course $= \frac{S}{2}$, and assuming this to act uniformly over the whole area.” He says that this resultant will be found by a graphical construction to pass at a distance $z = \frac{2}{3} \times \frac{d}{2}$ from the neutral axis. “Then,” we read, “moment of resistance in compression = area above neutral axis $\times$ mean stress $\times$ mean arm z , and this result $\times 2$ for corresponding moment in tension below neutral axis gives the moment of resistance M for the whole section,

or
$$\left(\frac{b \times d}{2}\right) \times \left(\frac{S}{2}\right) \times \left(\frac{2}{3} \times \frac{d}{2}\right) \times 2 = \frac{Sbd^2}{6}.$$

Surely it would be too much to expect a beginner to understand from this what is really intended and why the process gives the correct result.

Lower down the same page we have the method of determining the moment of resistance from the resistance area of the section.

As the author has not developed further the direct method of determining the moment of resistance by adding together the moments obtained from the individual layers, the reader is not introduced to the consideration of the moment of inertia of a section until sheet 6. There Mr. Charnock determines an approximate value for the moment of inertia I of a section of the rectangular beam, and assuming that the true value is $\frac{bd^3}{12}$, he notices that $I = \mu y_0$, when μS is the moment

of resistance already obtained and y_0 the distance of the extreme fibre from the neutral axis. This is considered sufficient to convince the student that the formula $I = \mu y_0$ is true for any beam, whatever the shape of the section.

One would forgive Mr. Charnock for not proving the important principles on which he bases his methods, if he only presented them clearly and in some order, so as to rivet his pupils' attention upon them; but one cannot pass over such proofs as these. Now it is quite easy to demonstrate in a general way that the total normal stress on either side of the neutral axis may be expressed in each of the following equivalent forms:

(i) $\frac{S}{y_0} \times$ moment of area of section on that side;

(ii) $S \times$ resistance area on that side.

Also, as the normal stress above the neutral axis must form a couple with the normal stress below, we have the equivalent results:

(i) The neutral axis contains the centre of gravity of the section;

(ii) The resistance area above the neutral axis is equal to that below = A (say).

Again, it is also easy to show that the moment of resistance of the section can be expressed in each of the following forms:

(i) $\frac{S}{y_0} \times I$;

(ii) $S \times A \times a$;

where a is the distance between the centres of gravity of the two areas A .

The product $A \times a$ may usually be readily determined with sufficient accuracy from the diagram, as Mr. Charnock says, and I may be deduced by multiplying by y_0 .

In the case of the rectangular beam,

$$A = \frac{1}{4}bd \text{ and } a = \frac{2}{3}d, \text{ so that } M = \frac{Sbd^2}{6} \text{ and } I = \frac{bd^3}{12}.$$

The book is useful for the sake of its practical examples of bending moment, shearing force, and other diagrams, but we would recommend the student to acquire a mastery of the principles involved by a study of other works.

W. J. DOBBS.

Primer of Geometry. By H. W. CROOME SMITH, B.A. 2s. 1902. (Macmillan.)

This little book seems to be intended for the teacher and not for the pupil. In these days, when there is some prospect of being freed from the fetters of Euclid, such a book should be welcomed by those who are considering the future of geometrical teaching. Not the least valuable part of the book is the admirable preface. There we find an eloquent plea for the abandonment of Euclid, and for the separation of the course of theorems from that of constructions. The definitions and the notes thereupon are carefully done. One may not agree with all the details, but the general idea is very suggestive. It is somewhat surprising, in so revolutionary a work, to find Euclid's definition of a tangent preferred to the 'limit' definition. The word *duplicates*, to describe figures equal in all respects, is a good one, but is hardly likely to replace the term *congruent*.

A very natural order of propositions is given in which the theorems are made independent of the methods of construction, and is very like the orders adopted in the best continental and American geometries. Several questions will occur to the thoughtful reader, and their answers are still open to doubt.—If pupils are