

**Plain and Reinforced Concrete Arches.** By Prof. J. Melan, 1912; translated from the German by Prof. D. B. Steinman, and published by John Wiley & Sons, Inc., New York; Canadian selling agents, Renouf Publishing Co., Montreal. 153 pages of text, 44 text figures and one plate; size, 6 x 9 ins.; cloth. Price \$2.00.

(Reviewed by David A. Molitor, C.E.)

The book is a translation of Prof. Melan's article on arches, contained in F. von Emperger's *Handbuch fuer Eisenbetonbau*, second edition, Berlin, 1912.

While freely admitting the leading position of the author in the field of structural design, it does not follow that the present treatise adds very much to our knowledge of arches and the translator certainly overestimates the value of this work to American engineers.

Both analytic and graphic methods are given, though as a general criticism the latter should have received a more comprehensive treatment to enable one to handle these problems in the most proficient manner.

Several of the claims made by the translator in the preface are not justified by the contents of the book. Thus, the statement that "the graphic methods which are given, permitting the use of influence lines, will be found very practical, although new to American designers" is wholly unjustified. In the first place, only about 15 pages deal with applications of influence lines, and unless the reader has already acquired a knowledge of this subject from other sources, he will receive little enlightenment from the present treatise. The statement is, furthermore, not very complimentary to American designers, because anyone who has enough ambition to learn can readily acquire a most comprehensive knowledge of influence lines for all classes of structures, including arches in all forms, by consulting the leading American books on this subject.

The translator would also have us believe that the book abounds with "simple approximations and short cuts" for preliminary and less exacting designs, also easily applied formulae "for determining in advance the best curve for an arch and the required dimensions and reinforcement." While 21 pages are devoted to the derivation of approximate formulae, it is doubtful if any time can be saved by their use. The approximate crown thickness can easily be found by Tolkmitt's formula (see p. 306 *Kinetic Theory*), and the best way to obtain the economic shape of an arch ring is undoubtedly to draw the equilibrium polygon through the centres of the crown and springing, for a load consisting of the total dead load plus half the uniform live load distributed over the whole span. This is better than any analytic investigation, for preliminary purposes, and a three or five centre curve can always be fitted to the polygon so obtained, which is close enough for all purposes.

The calculus is freely made use of, although this is not mentioned for the benefit of the prospective reader who might or might not be supplied with this working tool.

Castigliano's theorem or differential derivative of the work equation is employed as the solution for the redundant conditions and leads to the same identical results as Mohr's work equations, but by a more circuitous process. These general work equations were published in *The Canadian Engineer* for April 30, 1914, p. 679, in a review of "Suspension Bridges," by Prof. Burr, and afford the most complete solution for any structure involving redundancy in any degree.

On p. 21 it is stated that "the more exact investigation of large bridge arches demands the consideration of the critical loading for each individual arch-section, and

the problem of moving concentrations may also occur." At the bottom of the same page it is advocated to analyze the stresses in terms of the normal thrust and bending moment instead of by two different influence lines for the core points, claiming this to be a saving. The last sentence of the top paragraph, p. 22, then admits, "It is, therefore, necessary to determine the influence lines for M and N."

Two influence lines are always necessary to determine the stresses in any section, whether these are derived for the thrust and one moment or for two moments about the core points. The influence lines for the core point moments, being similar, are easily drawn. Also, since there are only a few sections where the stresses become maximum, the work of analysis can be reduced to a minimum by dealing with these critical sections only. That makes in all 3 pairs of influence lines for the symmetric arch and five pairs for the unsymmetric arch to accomplish a complete analysis by the most exact method ever given. Referring now to the example of the graphic analysis given on p. 142, for a 96-ft. arch, the author employs 28 influence lines. As the location of the critical section is not mentioned or discussed, the reader is advised to examine "each individual section," which apparently involves much unnecessary work.

Comparing the two methods of subdividing the arch ring for the purpose of the analysis, it should be mentioned that the equal divisions on p. 45 are preferable to the unequal divisions given by Schoenhoefer on p. 46.

Referring to temperature stresses on p. 55, the Austrian and Swiss specifications are offered. They provide for + or - 27° F. from the unstressed condition. In this country it will be found far better to provide for a rise of about 20° and a drop of about 40 to 50°, since the mean temperature during construction will usually be around 70° in summer and the low winter temperature is always responsible for cracks, if they occur.

It should be pointed out that steel reinforcement is a costly remedy for overcoming tensile stresses in an arch ring of improper shape. Therefore, the designer is always warranted in giving considerable attention to this important feature of design, limiting the tensile stresses to those produced by temperature, and choosing the arch axis so that the tension in extrados and intrados shall be nearly equal.

The book contains 8 minor examples and two larger examples, and might be characterized as somewhat deficient in this respect.

The contents of this volume is largely a repetition of what is given in Melan's "Theory of Arches and Suspension Bridges," also translated by D. B. Steinman, though more attention is here given to concrete and reinforced concrete. The publishers have maintained their characteristic excellence in the production of this book, yet it contains little or nothing that is not already accessible and perhaps more exhaustively treated elsewhere in American literature.

**Practical Irrigation and Pumping.** By Burton P. Fleming, Department of Mechanical Engineering, State University of Iowa. Published by John Wiley and Sons, New York City. Canadian selling agents, Renouf Publishing Co., Montreal. First edition, 1915. 226 pages; 62 illustrations; 5½ x 8 ins.; cloth. Price, \$2.00 net.

This book deals with water requirements, methods of irrigation and analyses of cost and profit. The subject of irrigation is considered principally from the stand-