

is therefore believed that wrought iron cross ties serve a better purpose in reinforcing the cylinder saddles than would be obtained by increasing the saddle length, and with much less increase of weight. Where cross ties are used suitable flanges, of course, should be provided on the cylinders to resist the pull of the cross ties. Inside lips on the cross ties are unnecessary, and if well fitted prevent the cross ties being shrunk on after the frames are bolted in place. The advantage of cross ties is shown from the fact that they are used successfully to hold cylinder saddles after cracking, and therefore cannot fail to assist in preventing cracking. Long transverse bolts through the cylinder saddles serve the same purpose in holding the saddle together as cross ties, and have been found very useful on many roads, but they are not thought to be as effective as cross ties, as they do not assist in holding the frames to cylinders and cannot be spaced as advantageously to resist bending strains in the saddles. They are useful, however, for cylinders having single front frame connections. Where used they should be placed as low down in the saddle and as near the back and front as possible.

BOOKS AND PAMPHLETS.

"Railway Construction," By William Hemingway Mills, M. Inst. C. E., Past President of the Institution of Civil Engineers of Ireland and Engineer in Chief of the Great Northern Railway of Ireland, New York, London and Bombay: Longmans, Green & Co., 91 Fifth avenue, New York, 1898. Large octavo, 366 pages; many illustrations and index. Price \$5.

This is an excellent book on English railway construction, giving in considerable detail the methods of conducting work in construction and maintenance of stations, bridges, foundations, track, culverts, walls, sidings, switches, interlocking, signal and brake apparatus and some general treatment of locomotives. The work opens with the location and government regulations, followed by chapters on works of construction and permanent way, stations and other buildings. Sidings, turntables, water tanks and water columns are treated in turn, after which a whole chapter is given to weights and types of locomotives. Signals, interlocking, telegraph and staff systems occupy another chapter, and the closing pages treat of railways of different ranks, progressive improvements, growing tendency for increased speeds with corresponding increase in weight of permanent way and rolling stock, the last subject treated being electricity as a motive power.

What may be termed the massive solidity and conservatism of the book is best expressed by quoting its closing paragraph: "Strength and efficiency are the leading points which must be always kept in view, and the engineer must never forget that he is solely responsible for the safety of the line and works, and that of the public passing over the same." Instead of presenting details of construction Mr. Mills attends chiefly to general principles and leaves the application of these to those who educate and train engineers for their work. He shows many examples from practice, and these have evidently been selected with great care in order to record only what is trustworthy. He also leaves matters of cost to others, but it is clear that he does not always consider the matter of cost as sufficiently important. We believe that American practice shows examples of equally good methods that are sometimes much less costly. He does not like our flanged rails, preferring the "bull-head" section, saying of the flange rail: "Having fewer parts, it makes a cheaper road than the bull-head rail, but is not considered so strong or suitable for heavy and fast traffic."

When he writes of brakes for freight service he is amusing; for instance, he says on page 46: "Every goods wagon should be fitted with a brake, and it would be of immense value if that brake could in all cases be applied and controlled when the train is in motion." This is followed by a detailed description of an American freight car hand brake, and herein is a commentary upon English freight brakes, because of our ordinary hand brakes being considered interesting enough to take the space of a book that is intended to be up to date. A primitive braking appliance, the "sprag," is described. It is a wooden bar passed between the wheel spokes to skid the wheels and assist in safely passing heavy downgrades. We would suggest that English railroad men order a car load or so of Westinghouse catalogues. The work under consideration is certainly weak in regard to brakes, but throughout we see indications of a desire to benefit from foreign practice when it appears to be available. For example, American "bogie" engine trucks are illustrated and the au-

thor says: "Its recommendations are its simplicity, its efficiency and its accessibility for inspection and lubrication." Mr. Mills appears to be afraid of heavy locomotives, thinking that they are not steady and safe on the rails. He means to be always on the safe side of every question. He approves the ten-wheel type as used in the United States.

The strongest feature of the book is in presenting a large number of examples of successful practice. It will have the greatest value in countries where English practice is followed, and it records much that American engineers ought to know about. As presenting a general view of railway construction, from the point of view mentioned it is successful.

The engravings are good, the letterpress excellent. It is printed on unusually good paper and the binding is serviceable. It has an index, but we would like to see more cross references.

"The Indicator Handbook." Part I. The Construction and Application of the Indicator. By C. N. Pickworth, Editor the "Mechanical World." 126 pp., 81 illustrations. D. Van Nostrand Company, 23 Murray street, New York. Price, \$1.50.

This is a valuable little book. It treats of the indicator, its use and its errors, while Part II. will treat of indicator diagrams and their analysis. There is much that is new in Part I., the illustrated descriptions of the Wayne and the Simplex instruments having their springs outside of the instrument, and away from the influence of the steam, being specially noteworthy. These indicators are described here for the first time in a work of this kind. The Wayne indicator uses a rotary instead of reciprocating motion for the piston and the card is held on a curved shield, the pencil movement being radial to the paper. The descriptions of these and the more common instruments are well written, and the author takes pains to bring out the characteristic features of each type and each design. All the reliable instruments are included. Indicator attachments and reducing motions are given a good share of space and the errors of the indicator itself and of the reducing motions are very fully treated. The most common rigs are shown in small scale drawings, and below them are scales which show the errors very clearly. Among the errors of attachment are those due to long pipes and long cord connections. Methods of testing are described. The book will be useful to engineers, even those who have had a great deal of experience with indicators, and to students it will be valuable as a text book. It is up to date and its purpose is so well carried out that we look forward to the appearance of Part II. with considerable interest. Part I. is complete in itself, it is well written, printed and illustrated, and is of a convenient size, 5 by 7 $\frac{1}{4}$ in. The author shows that he thoroughly understands his subject.

"Universal Directory of Railway Officials, 1898." Compiled from official sources by S. Richardson Blundstone, editor of "The Railway Engineer"; price 10 shillings. The Directory Publishing Co., Lim., 8 Catherine St., Strand, W. C., London. Representative for the United States: E. A. Simmons, 717 Chauncey St., Brooklyn, N. Y., 1898; pp. 475; boards.

We look upon this publication as a necessity in any office where there is occasion to look up the names and addresses and amount of equipment of foreign railroads. The revision this year has been carefully made, as usual, and brought up to date as nearly as possible in a work of this character. The new lines added are in Denmark, China, Nicaragua and Sudan, and also light railways in the European countries. The preface states that, with exception of the African German colonies, information respecting every railway in Africa is now included in the directory. Twenty-five pages have been added to the directory section and the personal index has been made proportionately larger.

"Administration Report on the Railways in India" for 1897-1898, by A. Brereton, Esq., Director of Railway Traffic and Statistics, Part I., Simla, 1898, Government Printing Office.

"Some Statistics of Engineering Education," by Dr. M. E. Wadsworth, President of the Michigan College of Mines, Houghton, Michigan. A reprint of a paper read before the Lake Superior meeting of the American Institute of Mining Engineers.

"The Elective System in Engineering Colleges," by M. E. Wadsworth, Ph. D., Director of the Michigan Mining School, Houghton, Michigan. A paper reprinted from the proceedings of the Society for the Promotion of Engineering Education, Buffalo meeting, 1896.