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*THE PRACTICAL METALLURGY OF STEEL.*

*Liquid Steel, its Manufacture and Cost.* By David Carnegie, assisted by Sidney G. Gladwin. Pp. xxv + 520 + x plates. (London: Longmans, Green and Co., 1913.) Price 25s. net.

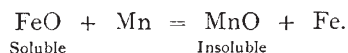
THE outstanding features of this valuable book are its most useful tables of the costs, both of plants and working expenses, which, as the authors point out, are approximate, being subject to the market fluctuations of material and labour. The first fifty pages of the book deal with the various materials used in steel manufacture, opening with a disconcerting table of the world's output of steel ingots. In 1910 the United States of America made about 26,000,000 tons, Germany 14,000,000, and the United Kingdom only 6,000,000 tons. The authors point out that Germany became easily the second steel-producing country of the world owing to the introduction of the basic process, a method worked out by British metallurgists. The authors, however, do not sufficiently emphasise the fact that Great Britain now holds her position in the steel world on the quality, and not upon the quantity, of her output. The materials dealt with by the authors in their opening section also include fuels, refractory materials, fluxes, and ferro-alloys.

Part i. of the book deals with the crucible process, and the authors very truly point out that for quality (in spite of various new and valuable methods of steel-making introduced from time to time) steel made by Huntsman's process has remained supreme so far as quality is concerned for more than 170 years. In a paragraph on p. 51 the authors state that for the killing of steel ingots by means of metallic aluminium "Mitis brought out his method." The reviewer suggests to the authors that the use of aluminium (originally employed for making very mild "mitis" steel castings) was discovered by Nordenfeldt and Oestberg in Sweden about 1885. Its use for killing crucible steel ingots was first elaborated in a research forming the subject of the presidential address inaugurating the formation of the Sheffield Metallurgical Society in 1891. The authors deal with the slight but important chemical changes taking place in the crucible process in a lucid and accurate manner, though the sulphur increase from 0.05 to 0.09 per cent., noted on p. 53, suggests the use of a coke very high (say 2 per cent.) in sulphur.

Part ii. deals with the Bessemer process, and here the authors do not appear to have fully

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realised the differences between the English Bessemer process and the Swedish Bessemer process, nor to have grasped the vital feature of Mushet's patent which made English Bessemer steel a marketable product. The essence of Mushet's contribution was to remove the dissolved FeO, which rendered Bessemer's blown metal hopelessly red-short, by the following reaction:—



Hence the insoluble MnO passed into the slag, and the de-oxidised steel forged readily. In Sweden, instead of adding metallic manganese at the end of the blow it is present to the extent of, say, 3 per cent. in the pig iron, and hence the formation and solution of FeO during the blow is prevented. With the above exceptions the acid and basic Bessemer methods and surface-blown modifications, such as those of Robert and of Tropenas and of Stock, are well described. A valuable chapter on blowing engines is included.

Pages 253 to 257 deal with the "physics" of Bessemer steel castings, an unfortunate term from a scientific point of view, since it has reference to the amounts of ferro-silicon, ferro-manganese, aluminium, &c., necessary for the production of sound steel castings. The term "additions" might well be substituted for that of "physics."

Part iii. deals with the open-hearth process, and gives a very valuable series of illustrations of the various types of furnaces employed. An equally admirable section deals with the various designs of gas producers. The consideration of the open-hearth process is concluded by a most useful set of examples of the charges, analyses, and uses of open-hearth steel, and a brief consideration of duplex methods.

Part iv. is devoted to electric steel-making by both the arc, induction, and combined methods, but it does not make a very clear differentiation between results which are obviously theoretical or estimated and those obtained in actual practice.

Part v., and last, is devoted entirely to costs, and will without doubt be of great use to works managers.

This book is written with a knowledge obviously the result of experience, and great care has been exercised in selecting information likely to be of practical importance. It may be unhesitatingly recommended as a work of standard rank.

J. O. ARNOLD.

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