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Review of: " PLANT DESIGN AND ECONOMICS FOR CHEMICAL ENGINEERS " MAX S. PETERS: McGraw-Hill Book Company, New York, 1958. 511 pp. \$11.00

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PLANT DESIGN AND ECONOMICS FOR CHEMICAL ENGINEERS*

Book Review

By

J. I. Peters

E. I. du Pont de Nemours and Company, Inc.

This volume is very ambitious in concept and wide in scope. It attempts to introduce the senior undergraduate or the graduate student to the concepts of economics used in industry and to connect the design of equipment with economics. In this it succeeds admirably. One third of the book is concerned with economics such as costs, interest and investment costs, taxes and insurance, depreciation, alternative investments and replacements, cost estimation, and cost and asset accounting. The remaining two-thirds of the book covers design considerations for plants and equipment.

The section on economics can serve as a very good, practical introduction to the field. It will no doubt not please the professional cost engineer; but, after all, it was not meant for him. It could, however, with advantage have been expanded to include a more theoretical treatment of the subject. On the other hand, the design section contains so much extraneous material that it can serve as a refresher for rusty engineers. This was certainly not the purpose, and it is hoped that it will be abbreviated in the next edition.

Because of the brief, practical treatment of economics, many more references, with abstracts of some in the appendix, would be useful. The discussion of the different types of estimates does not contain a listing of the accuracies expected. The names for different estimates differ in different firms, but generally the same stepwise procedure is followed from a

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high-spot estimate for development and research purposes only to a final construction cost estimate on which the final decision is based. The accuracy required at each stage varies. The first estimate may be $\pm 50\%$, the final one $\pm 10\%$. The accuracy obtainable depends upon the status of the technology and knowledge of the equipment required. Certain items, like power and operating labor, can, however, be predicted with fair accuracy from a preliminary flow sheet. These factors balance the more unpredictable items to allow the experienced engineer to arrive at an estimate within the $\pm 50\%$ range with relatively scanty process data.

The book does not contain a typical mill cost sheet for a product. It might be said that the book is meant for design engineers who will not have to calculate the cost of individual products. Yet the inclusion of discussions on operating labor, depreciation and similar items obviously makes it suitable for the engineer with wider plant responsibilities. Since an industrial firm has the primary responsibility to its stockholders of earning a fair profit on its capital investment, the mill cost sheet is of utmost importance. The operating man has to justify his employment by constantly improving cost performance. The effectiveness of the design engineer's work is also reflected in the cost sheet. The young engineer entering industry gets very confused when faced with cost sheets, frequently with no explanation of the terminology. Professor Peters could, therefore, improve the usefulness of his book by a brief discussion on this topic.

There are numerous arguments advanced by cost engineers for different methods of calculating profitability of investments. Professor Peters mentions them but discusses only the rate of return on investment as a criterion. While this, in the opinion of many writers, is the most widely applicable method, more discussion of the alternatives would be desirable.

The statement "In ordinary chemical plants, working capital amounts to approximately 10 to 20 per cent of the total capital investment" is misleading. It is impossible to generalize since

there are no "ordinary chemical plants". However, to give the student a correct idea, a wider range should be quoted, 10 to 40 per cent, perhaps. If figures are available, they should be tabulated. The values of individual items contained in the working capital and the arguments for their variation should also be discussed. The pharmaceutical industry, for example, uses very different factors from the heavy chemical industry.

Similarly, this volume would be improved by a better discussion of operating labor requirements. A typical job analysis could be added which would give the student an idea of what can be expected from a man. Industry has procedures for gauging job requirements and evaluating the labor costs accordingly. Inclusion of some such data would be useful, if only to prepare the student psychologically for time allowed for coffee breaks, showering, and meetings.

The engineering design section of this book is very good, but perhaps too extensive. The chapter on "The Design Report" contains 22 pages, 10 pages too many. The chapter title "Materials Handling and Transfer Equipment" is a misnomer since it deals almost exclusively with pumps and piping. The addition of basic cost information on materials handling equipment such as hoists, bucket elevators, moving belt and vibratory conveyors, would be very useful to the practicing engineer. The sections on mass and heat transfer equipment are very good. They contain a lot of useful know-how and practical data. The discussion section could, however, be abbreviated.

In addition to problems at the end of many chapters, 24 pages of major problems are appended. It would be useful if answers were supplied to some problems and if at least two of the appended problems were worked out in detail to demonstrate how the discussion in the back can be applied to solutions of larger plant design problems.

The above comments highlight the shortcomings of the book in order to supply constructive criticism which will be useful for a second edition. Such an edition would be well received,

since the book is very good. It contains a good basic, practical discussion of economics in relation to engineering design and will thus be useful to the non-specialist chemical engineer. It contains a wealth of very useful cost information which could be even more useful if better indexed. It is also one of the very few technical books to include a discussion of compound interest with formulas and tables. Because of the practical approach and the ample cost data which are included, this book by Professor Peters will be a useful text as well as a handy reference volume for the practicing engineer.

This reviewer wishes to acknowledge the stimulating discussions on the book with J. H. Norton and C. C. Ballard of the du Pont Company.

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