ting mills the cutters are seldom as economical as they should be, and while wastes may not run more than 6 to 18 per cent of the total cost of knitted cloth, if the waste average is reduced only 1 to 2 per cent this may amount to $5000 or $8000 a year. In one mill making a high-priced product, cloth saved through waste reduction has run as high as $33,000 per year. Any plant manufacturing leather has an important waste problem. One of these making an inexpensive shoe has found it possible to pay its girl cutters as high as four to six dollars per week for waste reduction alone, and this with a greater factor of the saving to the company than to the employees.

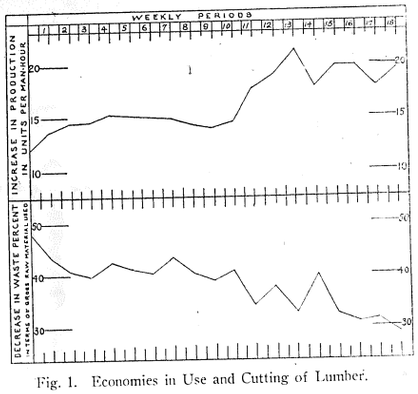

Fig. 1. Economies in Use and Cutting of Lumber.

There is another advantage to waste control in addition to the direct savings it can accomplish. Not infrequently departments where waste is a big factor are operated entirely on day work because it is anticipated that an incentive for greater production would make for faster work at the expense of greater waste, resulting in a net loss to the company. However, when the waste problem is thoroughly understood and proper standards established, production can also be safely increased by the use of incentives. Operatives can be held to strict accountability and no extra earnings paid for increased production unless waste is maintained at the same point or decreased. Frequently a combination incentive can be applied so that pay goes up in proportion as waste is decreased and production increased.

There are few manufacturing plants that can not increase their earnings and contribute to the reduction of waste in industry by the proper attack on this problem.

REVIEWS

Mastering Power Production. By Walter N. Polakov. Engineering Magazine Company, New York, 1921; 455 pp.

Books dealing with power plant practice usually cover either the technical or the commercal phases of the power generation problem. "Mastering Power Production" is principally an exposition of the philosophy involved and especially as applied to economic questions and to the relationship between the men who perform the labor and the men who control the capital and own the resources utilized in the process.

The introduction is an outline of the author's theory of production in general. This theory is best expressed in the author's own words as follows:

"During the past few years it became unmistakably clear that production carried out for profit only ruins itself in the long run and that the business that reckons with social requirements and meets the needs of society receives the highest reward."

Chapter I describes the power industry of the United States, the enormous growth of which in the last century the author attributes to three items: "Democratic Cooperation," "Realization of Importance of the Time Factor" and to "Electrical Energy or Power." The burden of this chapter is that "destructive competition" should be eliminated, and cooperative production is offered as the ideal substitute, i. e., cooperation between power properties and between capital and labor. "The Principles of Administrative Management and Operation will determine the success or failure of the undertaking." The main point in this chapter is waste and the argument that the present economic system makes waste necessary and therefore is a "System that makes commodities dear and men cheap." The author's answer is that this system will eventually destroy itself from within and that the only remedy is "a new mode of mastering production," and it follows logically in the author's mind that new principles and methods must be developed and practiced. A discussion of "Management" follows, further outlining how best to better production and thus place the practice of power generation on a sounder economic basis.

Chapters II and III cover "Location of Plants" and "Equipment of Plants." In these two chapters again the economic phase is stressed. The chapter on plant layout covers item by item the factors which must be considered, and suggestions are offered as how best to solve the problem. Emphasis is laid on arrangement for safety to the operators, and for convenience to assist in bettering operating conditions. Examples of faulty design are noted in numerous illustrations given of details such as gauge boards, safety treads and walk-ways, and special tools for performing special work.

The main division of this chapter might be entitled "Economic Conception," and therein the author gives numerous illustrations of engine and boiler efficiency tests and overall plant economy results designed to show present practice and comparative results between the better and the poorer plants. This chapter is summarized by the author when he again brings to the forefront his argument for "Management" by saying that to gain the correct conception of the value of the plant both for investors and the public one should know more than its physical properties—"a valuation should be made of the mode of its use, and that is primarily the method of its operation."

Then there follows four chapters relating directly to the title of the book, as follows:

"Mastering Material," "Mastering Maintenance," "Mastering Labor Problems," "Mastering Labor Compensation."

The first two of these chapters deal with technical engineering subjects from an economic viewpoint. A distinction is made between price and use value and numerous arguments given for placing the choice and purchase of material in the hands of the Production Department, otherwise, in general, the "engineering management." The relative value of coal determined by service test is brought forth as the most obvious example of the desirability of the above practice. Methods for handling material and for accounting therefore are discussed and examples and illustrations used to prove the point. The relation between maintenance and efficiency is noted by curves and examples and argument made that adequate attention to proper records and scientific scheduling of maintenance will promote efficiency in power plant practice. The second two of these chapters covers the labor problem from two viewpoints: first, the underlying philosophy, and second, the author's ideas as to the proper methods to follow in directing and paying for labor. The working day, the subject of fatigue, the theory of individual labor and the relation of the engineer to the laborer are among the items covered by this exposition of philosophy.

The basis of wages, incentive payments, profit sharing, premium plans, two rate wages, indicate the thoughts which the author offers in the second part. The brief review of the work of Taylor, Emerson and Gantt is followed by a description and charts showing the methods used by the author in his work of introducing management engineering methods into power plant practice. The basis of the author's scheme of payment for labor is a two-rate wage, adjusted for conditions beyond the control of the men involved and determined quantitatively by facts arrived at by proper installation and use of measuring instruments. It is claimed for this scheme that it results in profit both to the man who performs the work and to the payer of the wages. Such profit follows from the fact that the product of the efforts of the laboring man are determined and payment therefor made in proportion to the quantity and consequent value of the labor.

The eighth chapter, "Mastering Processes," gives examples, illustrations and charts showing, in considerable detail, the author's methods of management as applied to power plants. Pictures of instrument boards, outlines of steps in investigation made to determine the facts and show the losses, charts showing methods of graphic representation and calculation of facts and instruction cards giving the results of such investigations, occupy the principal part of this chapter. To an engineer interested in the details of power plant arrangement and routine operation the details covered in this chapter are illuminating and well worth careful consideration.

"Mastering Records" contains numerous samples of log sheets and description of methods used to analyze and summarize the facts so collected. A description and picture of a "Power Plant Log Calculator" is included. This chapter leads logically into Chapter X entitled "Analysis of Expenses," wherein the methods used to transform engineering data into dollars and cents understandable to the business executive are explained. Standard operating cost curves are given as examples with which comparisons may be made of actual performance. Such items as machine utilization and cost of idleness are discussed and their effects upon power production analyzed. Classification of costs, graphic cost records and methods of showing costs of purchased or manufactured power are explained in detail.

The last chapter is entitled "Power as a Commodity," and covers the history of the power industry. The burden of the entire chapter is the possibility of more complete utilization of our natural resources by the more extensive recovery of by-products from coal, the more extensive electrification of the railways, by less wasteful methods of mining coal, and further development of our hydro-electric resources.

The entire book is given over to a discussion of the best means to master power production and the need for this mastery is best expressed in the author's words as follows:

"We need no new inventions, no new machinery, to eliminate a fabulous proportion of losses incurred to-day due to lack of co-ordinated knowledge, cooperation and managerial ability; and intelligent mastering of power production for the benefit of the community is alone capable of conserving three-quarters of our power resources, increasing the productive capacity and the wealth of the country almost beyond conception."

In conclusion, this book is not for the technician but for the engineer who wishes to obtain a broader view of power engineering and at the same time has enough experience with the realities of the business to sift the ideal from what is at present practical. The book reflects the theories of a school of efficiency engineers and applies these ideals to the power industry in a manner which, while perhaps not commercially practicable at the present time, is nevertheless illuminating and inspiring to any power engineer who is not totally absorbed in technical details.

ALFRED IDDLES.[1]

The Twelve-Hour Shift in Industry. By Committee on Work-Periods in Continuous Industry of the Federated American Engineering Societies. E. P. Dutton & Co., New York, 1922.

Prepared by a committee of the Federated American Engineering Societies, "The Twelve-Hour Shift in Industry" will no doubt have a wide reading by members of the specifically engineering professions. But it should find a far wider audience. It is important as the first comprehensive inquiry into the extent of the anachronistic twelve-hour day in continuous industries. It is important as demonstrating that in the steel industry especially the twelve-hour shift is without valid technical or economic excuse. Above all it is important because through it the engineers as a body have declared their independence of those professional taboos which have hitherto kept them too discreetly aloof from great social and ethical controversies such as that which for more than a generation has raged about the twelve-hour day in steel.

For while the volume under review deals at length with the strictly technical phases of the problem involved in the change from the two-shift to the three-shift system, its acknowledged inspiration is ethical and social. "The desirability of abandoning the two-shift system," the engineers say, "lies not in the extent to which it is used but in the fact that the twelve-hour shift day is too long when measured by twentieth century ideas as to the proper conduct of industry. Decisions are influenced to-day by humanitarian considerations as well as by the economic demand for that length of a day which will in the long run give maximum production." And as if aware that what they have thus said runs counter to the traditional etiquette of their profession, they hasten to add: "This declaration the Committee believes is not controversial."

While acknowledging their indebtedness to such studies as the Interchurch Report, whose finding with respect to hours and wages their findings in the main confirm, the engineers have taken nothing for granted. They approached their problem with a healthy measure of scientific skepticism. They not only went into the facts as to the extent of the twelve-hour day in steel, with which the Interchurch Report was exclusively concerned, but they also surveyed the entire field of some forty or fifty continuous process industries in which the two-shift system survives. This general inquiry they assigned to Dr. Horace B. Drury, whose earlier study, "The Three-Shift System in the Steel Industry," was published in the February, 1921, issue of the *Bulletin of the Taylor Society;* the special section devoted to the iron and steel industry, they entrusted to Mr. Bradley Stoughton, Chief of Cost Statistical Division, American Steel and Wire Company, and formerly secretary of the American Institute of Mining and Metallurgical Engineers.

For the purposes of his investigation, Dr. Drury arranged the continuous process industries under four group headings: I. Heat-process industries; II. Chemical industries; III. Heavy equipment industries; IV. Service industries. "It would be hard," he observes, "to overstate the technical importance of the continuous industries. Our contact with their products is as intimate as our knowledge of the breakfast table—as witness *sugar* and *salt*, the *breakfast food*, *bread*, the *silver* on the

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