

The costs proportionate to the volume also tend to decrease somewhat as the lots become larger, due to the possibility of using large-scale equipment, which would be too great a burden on a small lot. There is no question any longer that the combined influence of these two reductions in cost with increasing volume constitutes a very powerful argument for continuous production. The country, however, is today in a very mixed state. Some industries, as the automobile, are well advanced. I believe a majority of the industries in the country are still of the jobbing type. Where this is the case the manufacturer finds himself in a dilemma when he seeks to increase his volume. The question cannot be settled without considering also the marketing phases of volume production.

Take the manufacture of screw-drivers as a case in point. There are, I believe, over one hundred screw-driver manufacturers listed in Thomas' Register. Many of these also manufacture a variety of other tools, such as braces and bits. Each of the hundred must divide the business with the other ninety-nine: must, to hold the trade of the people to whom he sells, make a relatively complete line including all sizes and grades. With hand to mouth buying, this means exceedingly small lots and continuous production is quite impracticable. No one of the manufacturers would be in a position to break the deadlock without the resources necessary to carry through a reorganization, not only of his production methods, but of his entire system of marketing. In time, of course, some one manufacturer is almost certain to do so, yet even the decision to specialize on one line is not sufficient for salvation, for regardless of what may be said of the economical advisability of this or that plan of production, manufacturers must still be controlled to a large extent by strategic considerations of their markets. Can the manufacturer afford to abandon his numerous small customers to a single jobber, losing the identity of his product and the control of his market? Such questions as these must be taken into account as qualifying the advantage of quantity production.

Mr. Schulz has emphasized in his talk, somewhat more than I expected him to do from his outline, the importance of engineering technique in the process of putting industry on the flow basis, and has given us a picture of the ultimate ascendancy of the engineering method. Such questions as that

already discussed—the strategic control of industry—indicate that the solution of business problems is not purely a matter of mathematics.

Unquestionably the engineering approach, when it is combined with experience and aptitude in diplomacy and dealing with men and with financial problems, tends to produce the very highest type of business leadership. Yet, by his nature, the engineer is a man who has probably been drawn to his profession by a preference for combat with things rather than with men. Mr. Hoover to some extent, I think, illustrates a native aversion to dealing with people, which has been corrected only as a result of a most determined self-analysis. Some years ago I read a very suggestive discussion by W. L. George of the various types of leadership. The article pointed out how the warrior, the priest and the lawyer had each been superseded because he turned his face to the past. Neither the business man nor the engineer is subject to this limitation. Neither is bound by precedent. Yet, of the two, because the engineer is interested in processes, while the business man is interested in results, George believed that in the end the business man would probably prevail. The type which is today prevailing is in many instances a type which starts with the rigid discipline of the engineer and ends with the intuition and the executive grasp of the business man.

Richard H. Lansburgh.⁴ I feel that Mr. Schulz has presented a very remarkable paper, and the distinctions which he has drawn between continuous, intermittent, and variable processing are very excellent. I am going to take only one phase of Mr. Schulz's paper for discussion and that is what he has had to say concerning mechanization. I will not agree with either Mr. Schulz or Mr. Willard in their comments on mechanization. Mr. Schulz indicated that he felt that the probability of workers' being thrown out of jobs through the introduction of new machinery was worrying employers to a greater extent than workers at the present time, and intimated that this situation would adjust itself.

I do not believe that employers are worrying about this new situation nearly as much as workers. In a survey which I made of a number of plants

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through the Middle West and East last summer I was unable to find a single executive who had given real consideration to what had happened to the employes that had been thrown out of his plant through the development of new machinery. On the other hand, workers, organized and unorganized, have been giving very deep consideration to this matter. They know it is idle to say that if a machine throws them out of work they will find employment in selling insurance, operating gasoline stations, or house-to-house canvassing. These are three of the employments, together with the rise of the radio and automobile industries, which have many times been given as the occupations in which men thrown out of work by new factory machines have found employment. As a matter of fact, we have seen some figures concerning the extent of increase of persons in these occupations, but we have no facts that this increase is composed of displaced factory workers. In addition to fearing the loss of his job and skill through the introduction of new machinery, a worker of today must fear inability to get employment if he is over forty-five years of age. The development of this new age limit in industry has done much to aggravate the conditions which have come about through the displacement of skilled labor by machines. For instance, the painter who has been thrown out of work by paint-spraying machines is not usually the type of man who can make a living selling insurance, or selling silk stockings by house-to-house canvassing. Many of these men are totally unfitted even to operate the paint-spraying machines which have displaced them, as the years of apprenticeship and experience in their trades have subjected them to lead poisoning and a general physical environment which has not been conducive to passing a physical examination in someone's plants. And, in addition, they now find themselves above an arbitrary age limit for employment.

Effects of the new mechanization in industry are peculiarly severe because it has been fashionable to deny that there are any ill effects. It is only as industrial executives throughout the country recognize the problem, and take means to attack it, that progress will be made. This will come about during the next few years, for there must come a very different point of view regarding age limits in industry. Executives will feel a greater responsibility for placing men that machines have

displaced in their organizations. If the purchasing power of the country is to be maintained, and therefore, if business is to be maintained, this point of view must prevail. We need much detailed study of the effects of mechanization, so that facts may replace theory and desire as the bases of executive action.

Clifton Reeves.⁵ It may be of real aid to the industrial engineer in introducing his work to form committees made up of members of a company's organization, after the organization has been sufficiently studied to determine who has the vision to properly appraise the value of engineering work. There is also a need for enlisting the active cooperation of the company officials and executives so that, after the consultant has completed his work, it may be taken up, carried on and improved upon by the regular staff.

A case I have in mind had to do with the formation of several very important committees to assist in bringing this particular property back to health and profits. The industrial engineer on the job was either chairman or a member of each of these committees. The first committee formed was the "economy committee." It was composed of certain office and plant officials and its function was to examine the duties and rates of compensation of all employees. It had also to consider matters of company expense and to recommend salary and personnel changes in order to reduce expenditures and increase efficiency. After this particular committee had been at work for about a year and a half the executive vice-president and general manager of all the six plants stated, before a meeting of several plant managers and executives, that the economy committee had effected savings in overhead amounting to over \$3,000,000 without interfering with good operation.

Our experience has been that this co-operative method of enlisting the help of the resident organization for the success of consulting engineering work is very necessary. We do not believe that most businesses are conducted by inefficient or poor methods. Our experience has taught us, however, that there are preventable wastes in industry. After close analysis plans can be formulated to prevent such wastes, whether they be due to improper

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