They are now engaged in doing more important work for bigger companies. That does not look as if we stifled initiative in the workman. There are many academic arguments that might be advanced with respect to that question, as to the workman's part, the part that he should have and the part that he does have. As a matter of fact, in every shop run under the Taylor system the workman has his part in the management, and it is a very big one. Take the matter of making time-study for determining the best methods to be followed in any piece of work. It is not the time-study man alone that determines that method. The time-study man does a part, and his part is principally observation and suggestion; but it is the workman, working with him, who does as much to develop the best method as the time-study man, and in many cases a great deal more. This is real, effective coöperation.

Concerning the question of instruction and of the workman's initiative: Take a young man coming into the shop as a beginner. Suppose that Dr. Drury came to the Tabor Manufacturing Co., and wanted a job; that he had little or no previous experience in machine-shop work. Suppose they said to him, "All right; you go out in the shop and go to work." Suppose that little by little we filled our shop with men in that way, who came in and wanted a job and had no previous training; and just said, "Go out in the shop and go to work; use your own ingenuity as to how the work is to be done; exercise your initiative; develop yourself; do your own planning"—how far would we get? The whole social organization would break down under such a scheme. Mr. Drury, if he came to our shop and got a job, would be thankful for the instruction and help that he got from the functional foreman, if he needed the job or needed the money.

There is one more thing that is overlooked by our various critics, and that is the element of responsibility. The men who are to have the say in the management of a plant must assume a certain responsibility for results. I have not seen that sentiment put forth in any criticisms of this kind. I think the important thing for our critics to do is to get into the work, and work with it and criticize after they have worked with it.

Professor Robert M. Haig:[1] Mr. Chairman, Members of the Taylor Society and Guests: I am not certain why I was invited to address you this afternoon, but I imagine it was because it was felt that it would be only humane to Professor Drury to have a fellow-economist present when his paper was to be discussed by a group of engineers! For affection toward professional economists is not one of the marked characteristics of the engineering profession. This is made very evident to any one who examines the literature of the field, and is even plainly shown by a number of the statements made in this afternoon's discussion. On the other hand, one does not have to search far to discover that the engineers do not meet with the entire approval of the economists, particularly when they attempt to deal with problems which are more or less economic in their nature. Consider, for example, that very irritating but essentially accurate portion of Professor Hoxie's recent book describing the manner in which the writers on scientific management have dealt with the labor problem—how they have put forward, with apparent confidence in their originality and essential soundness, "solutions" of the wage problem which have been abandoned by economists many decades ago. This situation is extremely unfortunate and some readjustment must be made if a proper rate of progress in the solution of the problems of industry is to be achieved.

The reasons for the lack of mutual appreciation and esteem are, in my opinion, not difficult to discover.—They consist almost entirely of misunderstandings due to ignorance on the part of each as to the value of what the other has to offer. The economists know little or nothing of engineering and they should know a good deal of engineering to deal intelligently with some of their problems. The engineers know little or nothing about economics and there are indications that they are beginning to realize that there are problems in the field of industrial management where a knowledge of economics would be useful.

The present situation indicates a fundamental lack in the system of training engineers, a lack for which the economists are in part responsible. Something should be done to impress students of engineering with the fact that a large part of their future success will depend upon the intelligence with which they meet the human problem involved. At present, the average student of engineering takes but a slight interest in his course in economics. He considers it something unessential and unimportant. Usually the time devoted to economics is much too short for a proper exposition of the subject and this is a factor weakening the interest. Doubtless much can be done by the economist to make his subject appeal more strongly to the engineering student, but after all, he labors at a disadvantage, for the training he offers can be realized upon only indirectly and at a more or less remote time in the future, while immediate recognition and advancement rest upon proficiency in technical and applied lines.

Even though it be granted that the economic training of engineering students should be strengthened, this will not entirely solve the problem. Much more could be accomplished if practicing engineers would inquire as to what the economists have to offer before laboriously rediscovering exploded "laws" and discarded solutions in their attempts to deal with the problems of management. Most of the criticism of Professor Drury's paper has been on the ground that he has not gained a full understanding of scientific management. Upon the justice of this type of criticism I am, of course, precluded from passing judgment, because I am not an engineer. I should like to make the point, however, that Professor Drury has at least made an earnest attempt to gain an understanding of your problem. It seems to me to be incumbent upon the engineers to make at least as earnest an attempt to understand what the economists have to offer. As evidence of the need of an acquaintance with economic theory, let me cite the fact that one of the leaders in scientific management recently devoted a substantial portion of a lecture before the graduating class of one of our engineering schools to an original version of the simple principle of elasticity of demand. To attempt to solve economic problems without utilizing the knowledge already made available by the economists is anything but scientific. It is criminally wasteful. The engineers should examine this field—should set a task for themselves, if you like, in the scientific literature of economics.

I think that we would all agree that Professor Drury is accurate in his analysis when he states that the place where scientific management has been least successful has been in its attempt to gain the good will of the working class. Its aims and ideals have not been set forth in such a way as to make them attractive to the mass of the workers in this country. This is something that must be done if scientific management is to persist. It must be explained and adjusted to fit as a social institution. It is a human problem and we have the authority of Mr. Gantt for the statement that it is these human problems which are of greatest importance. My contribution to this discussion is designed merely to point out the desirability of coöperation with the economists in solving these human problems. Any functionalization which makes the engineer-manager not also an economist is ill-adapted to the situation with which we are face to face.

Mr. Robert B. Wolf:[1] The last speaker has made a plea that the engineer study political economy. I should like to suggest that the reverse process would also be helpful. The political economist should make his philosophy pragmatic by getting into closer contact with the every day problems which the engineer is trying to solve. I say this with all kindness and no thought of disrespect for the economist in rendering a real service. The present day political economy, however, does not adequately answer our needs for it is not sufficiently constructive. The abstract academic theories of the analyst will not lead us to a real basic conception of the reason for human activity so long as it is assumed that selfishness is the dominant emotion in the human heart instead of the desire to find self expression in creative work.

Mr. Sanford E. Thompson:[2] Many of the criticisms made by Professor Drury do apply to modern industrial methods as commonly practiced. However, it is just such dangers as he speaks of, just such faults of management, that scientific management is striving to overcome. Scientific management provides by its functional methods a distribution of managerial duties among a large group of men who supervise the various functions of planning, routing, inspection, training of the workers, and so on. This group of men is composed very largely of operatives who have shown themselves to be fitted for the various managing duties, many of whom without this opportunity would be confined perhaps for a life time to machine or hand labor. One of the chief aims of scientific management and one which affords the greatest benefits to the entire organization is the establishment of standards and the substitution of these standards for the haphazard and absolutely autocratic *opinions* by which the unscientifically managed shop is governed. These standards are not arbitrarily fixed but are the result of close scientific analysis conducted by an expert whose training and experience qualifies him for such work in exactly the same way as the training and experience of the expert diagnostician qualifies him for his. In both cases the expert is better able to tell what is the matter and how to correct it than the patient himself.

Such a set of standards once established are a guide to both manager and employee as to just what share of the work each is to do and how it is to be done. Neither is groping in the dark wondering whether what he is doing will merit praise or condemnation. If the standard is followed, each may be confident of the result.

Nor does scientific management shirk farther responsibility, once standards have been established. It patiently teaches the worker how the standards may be attained and maintained and thus trains and develops him into a more skilled and efficient worker. It insists that the conditions under which he works

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