

with a sort of a hoe. Other operations in this plant have been simplified by changing the position of some workers so that the porter who supplies materials can do so without interrupting and causing a stop in the work several times a day. A study of extra steps and little delays by an intelligent observer is a necessary work before the greatest efficiency can be secured. When all these analyses have been reduced to writing, a study of the type best fitted to do this work is made.

Second. Scientific Selection of the Worker. The type of worker who physically and mentally is best fitted to do a kind of work must be selected after a careful analysis of that class of operations made with reference to physiological and mental differences in human beings. The difference in output and quality of work has been found to vary as much as 40 per cent or 50 per cent in a group of men or women engaged on the same kind of work. As they were of apparently equal intelligence and education, this could be explained only by the physiological and mental differences. As a result of time-study and motion-study of various groups of operations in one large manufacturing plant, it has been found that there are so many workers performing a kind of work to which they are not suited, but who might excel in another kind of work, that the management has laid plans to establish classes to instruct workers to do another kind of work better adapted to their capacities.

Of two different departments, A and B, for instance—A containing thirty girls and B twenty—it has been found that over 20 per cent in A are unfitted for that kind of work, but would be fitted for work in B, and *vice versa*. A scientific selection of the workers is possible only from the analysis of operations. The effectiveness of this will be greater when the principles of the psychology of working and kinds of work are better understood by industrial managers.

The psychology of advertising has lately been coming to the front. The psychology of industrial workers is still a great field for research. The vocational schools will not perform their true function properly until they come to a better knowledge psychologically of the mental and physical requirements for different kinds of work, and are able by tests to determine in which their pupils are likely to be successes or failures.

Scientific selection of the *workmen* is but a part; the scientific selection of *foremen, of superintendents and managers is just as important*. How frequently one sees a man struggling with the details of an office or with the wear and tear of executive work, on the verge

of nervous prostration, when that man is wholly unfitted for that kind of work and his attempts successfully to perform it result in his undoing. If managers themselves knew how to judge a man's fitness for his work and were more observing, there would be many less breakdowns and physical wrecks than there are now.

Third. Training of the Worker. Having first carried out the study of the operation which has pointed the way to the proper selection of the worker, it becomes the duty to train the worker to do the work in the way which the result of the analysis has shown to be the best way. This will be accomplished by a functional foreman whose duty it is to train the workmen and help them on each job to get started right. If they fail to do the task in the time fixed it is the duty of the functional foreman to find out why they have failed, and to help them do the work as it should have been done. This is a wide departure from the old school, which assumes that the journeyman has sufficient knowledge to do his own work in the most efficient manner. In the training of workmen it is interesting to see how they develop through an aroused interest and cooperation of those over them.

Fourth. Proper Tools and Equipment. The fourth condition is that the worker be supplied with the best tools and just the ones needed for the particular operation, and supplied when needed; that he be given the best machine, maintained in first-class condition, so that machine, belt and tool failures will be reduced to the minimum. To maintain the machinery, etc., in this condition is a duty of the management, and *Scientific Management* provides the means with which to do this.

Fifth. Proper Incentive. Sufficient incentive should be given the worker to perform the operation or the task that has been set in the given time. To make this possible for the worker, functional foremanship is necessary and the principal object of such functional foreman is to assist the worker and eliminate trouble or delay. The functional foreman trained to his specialty will do this more effectively than the old-fashioned all-around foreman. Examples have been given by previous speakers of relative increase in efficiency of the worker as a result of *Scientific Management*. Of course such relative increases in output cannot be considered universal. Certain machines are not mechanically able to run at double or triple their former speeds, but *Scientific Management* tends to lessen the numberless little delays which the condition of the machine, of the material to be worked upon, or the instructions to the worker, may have been responsible for.

It must be to the financial interest of the worker to be industrious, and it has been shown to be for the interest of the management to do everything to make possible and profitable this increased industry of the worker, thereby gaining a more uniform output, and an output per man or machine which is maintained more uniformly in dull or busy times.

There is another feature which is of interest; that is, if the worker engaged on the task and bonus does not receive his materials promptly and on time, if his machine is not in the condition it should be, or there are other avoidable delays, the worker has sufficient interest in the probable loss of his bonus to make a serious kick, and it is the duty of the gang-boss to immediately right this trouble. Therefore, the workman and the boss are together demanding of the management that as nearly as possible perfect working conditions be maintained.

IV. CONCLUSION

The central planning and control of work which is such a vital part in *Scientific Management* is not developed to the same degree in the *systematized*. In *systematized* plants where complete planning is attempted, however, the instructions and orders particularize *what* is to be done rather than *how* it is to be done.

In the *systematized* plant the system in one department has been planned especially for that department, and is not a part of the system framework which pervades the whole, as in *Scientific Management*, and it is a constant fight to maintain such independent systems and especially to change and modify them with changed conditions or the increased growth of the business.

In closing let us see the effects of this type of management in general on the plant, the product, the worker and the management.

Plant. Scientific Management furnishes the machinery for maintaining the plant in better condition by centralizing the control, by the use of such devices as the standing order file in which are collected and reduced to writing and properly indexed the practices and rules of the company. From it, by listing and making a certain program of things to be done—the departments, machinery, shafting, drains, gutters, etc., to be inspected—this program can be handled month after month by routine in a manner which the management has carefully predetermined. To attend to the maintenance of a plant in this way is working to prevent delay and expense rather than cure it afterwards. For instance, eliminating delays due to belt failures, shaft-

boxes which have been overlooked and run dry, and indefinite inspection of premises, pipe lines, traps, etc., tends to save expense by preventing trouble.

Product. The product of such a plant should be more uniformly even, and there should be fewer mistakes and less inferior work. Once a standard is set for each operation, that standard can be maintained. It costs little more to maintain a high standard under these conditions than a low one under old conditions.

The Worker. The condition of a worker's mind has a very large effect on his physical being. There is a psychological effect on a worker in having the work divided into definite tasks, each one having its goal in sight and sustaining effort to that time. The piece-workers in one plant in which I am interested were interviewed by a woman journalist at the time so much publicity was given to *Scientific Management* by the hearings before the Interstate Commerce Commission, and she asked them how they liked the task and bonus. They said they didn't know why it was, but they liked it; they were earning more. But that was not all: the piece-work flowing to them in an unending stream had been discouraging; there was something they could not understand, but when it was broken up into definite lots they liked it much better. You can discourage any man by setting him to work with a pick and shovel and telling him to shovel away a hill. He knows he can never get it done, but if you say: "Here, you shovel so many tip-carts full in a day, or in a given time, and you will have a certain percentage of increase of pay for that time," you have changed the point of view, and that man every time he finishes a tip-cart full has accomplished a definite task. His effort is sustained for that time, and he is going to be able to sustain that effort in the future. That is one reason why profit-sharing among the working classes is almost an absolute failure so far as increased efficiency is concerned; the time of sustained effort for a year or six months is too long. Neither can a worker do his best work who is nagged by a foreman, who has been given insufficient instructions and is fearful lest he is doing his work wrong, and who, having made a mistake, is jumped on, oftentimes perhaps unjustly. He is not in a frame of mind to do his best work if he wishes to.

In one factory there was great difficulty in keeping the women workers in a certain department. They were either unwilling to continue to work or frequently gave out, and it was a puzzle for sometime to find out what the trouble was. When the analysis and time-study were put into this department, it was found that