

work. This is not what concerns us. This fatigue disappears entirely or in part every night by sleep and by rest on holidays. It is necessary and sufficient that this recuperation should be complete enough for the workman to find himself at stated periods in his accustomed health. The measurement, therefore, must be carried over a sufficiently long time to permit one to recognize very subtle progressive changes in the general state of health in order to avoid any accumulation of fatigue. But once these measurements were made, it would still be very difficult to distinguish what part of the over-exertion is due to the work of the shop and what part due to extraneous causes of fatigue outside of natural causes and illness. This problem is, therefore, still at the point where Taylor left it, and we do not yet know what will be the final solution. The intellectual point of view very completely preoccupied Taylor. According to him, we demand of the subordinate personnel of shops a task out of proportion to their abilities; the workman and the foreman are burdened with tasks which belong essentially to management. The principle of functional management must be applied to intellectual, as it has long been applied to manual, work and this work should be distributed according to the abilities of each. Taylor was thus led to important conclusions, but they are still very much disputed even, today.

It is impossible to permit the workmen to use their judgment as to the best methods of work. No workman is going to learn by five minutes of reflection before a turning lathe those most advantageous methods of procedure which it took Taylor twenty-five years of research to discover. The choice of the best routines of work belongs to the technical direction of the shops.

Taylor lays even greater stress on the absurdity of the exaggerated task given to foremen. They are expected to know everything; they must hire the personnel, oversee the work, verify the quality of the product and do the bookkeeping. If they were capable of properly fulfilling all these functions they should immediately be made managers of the business. But they are not supermen, and the penalty for these unfair demands has been inferior work.

Taylor divides the regular task of the foreman among eight persons—four shop foremen and four planning room employes. The objection to this

organization is the division of authority which may occasion contradictory instructions. As a matter of fact the workman really receives no orders except from one employe of the office plant, the general manager. The shop foremen are not, properly speaking, heads but only helpers. Moreover, they do not function at the same time, but successively. The first, whose duties are concerned with the management, has in charge the arrival at the proper time of *materials and tools*; in an emergency he helps the workmen put in place the pieces to be fabricated on the machines. The second acts only during the actual process of the work, to show the workman, if necessary, how to follow the instructions given by the manager. The third verifies the quality of the work after it is done and checks up the manufactured products and the time employed. Finally, the fourth is engaged with the upkeep of the machines and the cleaning up of the shop, which must be done between the periods of work. A good workman, moreover, who knows his job, has no need to keep in touch with the foreman; he finishes his task without having to ask any advice.

Taylor was even more preoccupied by the moral point of view. No success is possible in an industry without cordial co-operation between the employer and his workmen. This he regards as the important point of the problem of the human factor. He has studied this question experimentally by varying systematically his methods of relation with his personnel and noting in each case the results obtained.

Here are some of the rules on which he lays especial stress! First, he replaces work by the hour, or by the task, by work on a fixed task; that is to say, he establishes by predetermination the task which a workman can normally accomplish in a day and assigns it to him without permitting any discussion. This is the rule followed in the French schools, where the superintendent fixes the number of lessons for each professor and these in their turn determine for the pupils the length and number of their tasks. The habitual discussions between the managers and workmen on the length of the task are an inevitable source of irritation because, not knowing exactly what it is possible to do, both sides begin to lay down impossible propositions. They accuse each other mutually, and with equal reason, of bad faith.

It is not enough to fix this task fairly; it is also necessary to encourage the workman to submit to definite instructions, which are given him, and to do away with the necessity of idling, dear to every man. To this end Taylor gives a bonus to the workmen, that is to say, an addition to their wages each time that they accomplish the required task. They are thus put in a situation much more advantageous than that of their comrades who are working according to the old system. He recognizes that in order to give entire satisfaction to the workman it is necessary that the bonus be based on a percentage of the wages, varying from 30 to 100 per cent, according to the degree of intelligence necessary for the required task.

Taylor has also made experimental studies on the best system of discipline to use in the case of inefficient workmen. He recognized that it was better to impose a fixed penalty through the withdrawal of the bonus, on the failure to accomplish an assigned task, without adding any reproval or accepting any discussion.

In spite of these advantages, the system of the fixed task has spread very slowly up to this time because the determination *a priori* of this task is difficult; it presupposes a very complete knowledge of the technique of the work, on the part of the management personnel, much common sense, and finally, the conviction that the expense occasioned by the preliminary study of the work will pay in the end. Taylor is constantly insisting that the industrial leaders change their point of view about their workmen and convince themselves that many of their employes have a morality and intelligence equal to their own. The employers have only the advantage of a higher education and especially of acquired wealth. This imposes on them an obligation to make the first step toward accomplishing cordial relations.

#### Co-ordination

Modern industry is extraordinarily complicated and will become increasingly more so. Every article is composed of a great number of separate pieces. It has necessitated the employment of various forms of power, of different kinds of machinery, of many raw materials, and especially of the use of a great number of workers from time to time. The little artisan working alone in his room and finally succeeding in making a garment or a piece

of furniture is no longer known. Formerly the conductor of a diligence reserved your seat, received the fare, drove the horses, cared for them in the stable and cleaned up his carriage. Today every railway traveler sets in motion a large number of employes—the ticket agent, the train conductor, the engineer, the fireman, the station masters, the signal men, not to speak of the workmen who have built the roadway and the locomotives, and then have had charge of their maintenance.

In the end this complication gives a more economical result, but only on condition that all these services combining to a common end are perfectly co-ordinated, that each one does his task at the right time. This is so essential now that there is no modern enterprise where this co-ordination is not the object of the constant attention of its directing head. This is what they call his administrative function. Taylor has not invented co-ordination, but he has made a study of it as he has of all the factors of production with extreme care, always applying the maxim: Reflect-before you act.

In the first place, he has combined a whole system of forms in order to establish the relation between the different collaborators on the same product and to do it without the possibility of any such misunderstandings as are always occasioned by verbal orders. For example, the representative of the head of the manufacturing department sends the workman a written order to start manufacturing a given piece on a given machine, following a predetermined plan. He has already sent in writing, in the same way, the necessary instructions for the arrival at the exact moment of the piece to be worked upon; the separate accessories and even the tools are already being assembled in the shop. The slightest failure of co-ordination causes delays in the work which appreciably increase the cost.

In the same way he has studied tables and charts and even models in relief, giving at each point the statistical information that is of use so that those in charge of these operations may follow the progress of their orders, control the cost and be ready to market the article. This helps those in charge of manufacturing to establish the program of work in the shops. Taylor has also invented symbols and classifications to represent and to group all the elements of manufacture.