

experienced it so frequently to his sorrow. An organization worthy of the name gives every guarantee to the workman on this point, but it must convince him not so much by promises, which hardly affect him, as by making a business of demonstrating to him that order reigns in the house from top to bottom, and that no stone is left unturned to insure the greatest continuity of employment, which Taylor's detailed preparation and planning certainly succeeds in doing. Nevertheless, we must recognize the fact that the French workman loves to make an extra effort from time to time in order to be able to enjoy a period of relative relaxation afterwards. Careful selection of the workers, accompanied by methodical planning and instruction such as Taylor practiced, is certainly the first of the conditions to be realized in order to avoid speeding up, at the same time arousing an interest in the work and increasing the wages.

The question is, however, whether the workman is not discredited by a selection involving physical characteristics only and the specialization which results from it? In any case, Taylor is not responsible for specialization. It is inseparable from modern industrial processes, but it is forever being brought about by chance. The man who has to work for his living takes the first job which offers, even if he has none of the requisite qualifications; and he adapts himself to it as best he can, generally none too well. After a while it is extremely hard for him to make a change and there he is, rivetted for life to a job in which, having no aptitude for it, he will never more than passably succeed.

By helping him to orient himself in work which is more suitable for him through intelligent selection and proper training one renders him invaluable service.

Taylor has also been accused of taking no account of fatigue. It is true that he talks very little about it and, that he puts the emphasis upon production. But discovering fatigue to be the main obstacle to production, he does not confine himself to calling attention to the evil; he points out the remedy, and no one can deny that the examples which he cites in his Principles of Scientific Management are the best studies in fatigue which have ever been made.

The first example, that of handling pig iron, is a study of heavy work requiring muscular effort which only very robust men can bear, and even they only for a more or less limited period. There has always been an interest in eliminating this kind of work,

and the improvements effected have really made it increasingly infrequent. Taylor showed how even in such tasks as these production can be increased while fatigue is diminished, through having recourse to judicious selection and to the organization of proper rest periods, but this point has no longer anything but a scientific interest.

The second example, that of bricklaying, has to do with tasks requiring only a moderate effort, which are much more numerous in a modern shop. It shows the fatal influence of useless motions, frequently more fatiguing than those necessitated by the work itself, and from which the worker can be emancipated by convenient appliances.

Finally, the example of the selection of bicycle balls relates to tasks in which nervous tension is the predominant element. For work of this kind careful selection and proper rest are indispensable. The test of fatigue in this case is the slowing down of the work and the failure of production, which can be accurately measured. Another excellent test of the same kind used by the French is the result of sick leave reports before and after scientific management has been introduced. It is evident that the new methods are reducing fatigue if at the same time that there is increased production and increase of earnings there is also decrease of sick leave. Up to the present time laboratory experiments do not seem to have been able to give such exact figures on this matter.

There is still a question as to whether this problem of production to which Taylor attaches so much importance is as vital a matter in France as it is in America. Is production in France as inadequate as the examples Taylor enumerated? And if it is not as high as it might be, is that fact not more than offset by the quality of the product? May one not fear that an over-developed organization may destroy initiative and ingenuity and that ability to extricate himself from difficulties characteristic of the French workman, so important in the industries yielding those artistic products which occupy such an important place in France?

To answer this question one must be explicit. Not only publicists and philosophers, but economists and even manufacturers are constantly talking of management problems in the vaguest possible way, reasoning about an imaginary shop or workman who produces an indefinable object by an indefinable process. Or, if they stop to investigate an operation offered as an example, it is considered as something in-

tangible and not viewed in its relation to the evolution of industry and to its new tendencies. When they analyze the work they do it in a laboratory, taking the filing vice or the dock workman as a type, and the subjects under observation frequently lack training. Hence the extraordinary evaluations which we have heard.

To better understand the way the Taylor principles may be adapted to French industry let us take a purely industrial point of view and deliberately select a worker on an art product. In his way he is really an inventor; imagination and taste are the first considerations with him. He should no longer be obliged to work at purely mechanical tasks like those he frequently imposes on himself. The finest tools should be within easy reach of him and he should have every facility for preparing his work. This is what he may expect from a well-organized industry such as we are discussing and whose principal operations we shall attempt to define and to classify. These are—

1. *Conception or invention*, beginning with an initial idea and permitting the construction of an original model.

2. *Realization*, placed at the service of invention, giving it a definitive form; proving it out by more or less important applications.

3. *Production*, the manufacture of thoroughly defined products in greater or less quantity by the most approved and the least expensive methods.

*Invention* occupies a very honorable place in France, a fact generally recognized, particularly by Americans. In invention France is extremely active, but she is notorious for the simple facilities which she uses in putting original models on the market. It may be said that scientists and artisans vie with each other in ingenuity in this matter. Industrial organization has been accused of stifling invention, its lack of flexibility making one hesitate to undertake new kinds of manufacture. This reproach cannot be brought against Taylor, for his methods always have a tendency to give more flexibility to the shop. It must be remembered also that invention is not concerned solely with devising a new product; its object may just as often be the contriving of new methods of making a model commercially practicable. It is an immense field and the analysis of work constantly suggests new objectives for this kind of invention which it is hoped the French will be more and more eager to develop.

*Realization*, the creation of a final marketable model, is an operation differing entirely from the first. According to circumstances it may be rapid, made easily in a short space of time, or it may be laborious, that is, it may demand more or less time and great expense. Examples of the rapid development of an invention are numerous in France. Some time ago the Jacquard engine made rapid strides; French automobiles demonstrated what could be expected of this mode of locomotion before those of any other country. This can be attributed in large measure to special ingenuity in the use of emergency means called by the French "débrouillage." But technical refinement is fruitful in proportion to its facilities. And even such resourcefulness increases in proportion to its facilities, and scientific management comes to its rescue by placing very definite facts and processes at its disposal. In many cases, however, the final development of an invention is bound to be laborious, and it is in America that the most remarkable examples must be sought extending over scores of years and involving expenditures running into millions of francs. In France many inventions have not gone beyond the first stage, or the creation of a definitive model. Realization, in the sense in which we use the term, requires a long time and especially great expense, and has not been pushed to its ultimate possibilities in France.

This was true of the sewing machine which Thimmonier invented in 1825, the typewriters of Xavier Progin in 1833 and of Foucault in 1842, inventions which have not been developed like those which originated in America for the reasons which we have just given. We would have known very little about the French inventions if it had not been for the models deposited in the Conservatory of Arts and Trades beside Vaucanson's automaton, where their main function is to establish the priorities should they be claimed by others.

This laborious realization can be brought to a successful conclusion only by applying the scientific method to the last degree, as Taylor did for the cutting of metals; and if in the future we wish to reap all the benefit from our inventions without waiting for them to return to us from foreign shores, we must hold on to them and must learn how to find the necessary resources here in France.

*Production* covers an extremely broad field including systematic mass production as well as production of individual objects. Whichever it concerns itself