

ing it to laws, rules, and even to mathematical formulae, is voluntarily assumed by the scientific managers. And later, when these laws, rules, and formulae are applied to the everyday work of all the workmen of the establishment, through the intimate and hearty cooperation of those on the management's side, they invariably result, first, in producing a very much larger output per man, as well as an output of a better and higher quality; and, second, in enabling the company to pay much higher wages to their workmen; and, third, in giving to the company a larger profit. The first of these principles, then, may be called the development of a science to replace the old rule-of-thumb knowledge of the workmen; that is, the knowledge which the workmen had, and which was, in many cases, quite as exact as that which is finally obtained by the management, but which the workmen nevertheless in nine hundred and ninety-nine cases out of a thousand kept in their heads, and of which there was no permanent or complete record.

A very serious objection has been made to the use of the word "science" in this connection. I am much amused to find that this objection comes chiefly from the professors of this country. They resent the use of the word science for anything quite so trivial as the ordinary, every-day affairs of life. I think the proper answer to this criticism is to quote the definition recently given by a professor who is, perhaps, as generally recognized as a thorough scientist as any man in the country—President McLaurin, of the Institute of Technology, of Boston. He recently defined the word science as "classified or organized knowledge of any kind." And surely the gathering in of knowledge which, as previously stated, has existed, but which was in an unclassified condition in the minds of workmen, and then the reducing of this knowledge to laws and rules and formulae, certainly represents the organization and classification of knowledge, even though it may not meet with the approval of some people to have it called science.

The second group of duties which are voluntarily assumed by those on the management's side, under scientific management, is the scientific selection and then the progressive develop-

ment of the workmen. It becomes the duty of those on the management's side to deliberately study the character, the nature, and the performance of each workman with a view to finding out his limitations on the one hand, but even more important, his possibilities for development on the other hand; and then, as deliberately and as systematically to train and help and teach this workman, giving him, wherever it is possible, those opportunities for advancement which will finally enable him to do the highest and most interesting and most profitable class of work for which his natural abilities fit him, and which are open to him in the particular company in which he is employed. This scientific selection of the workman and his development is not a single act; it goes on from year to year and is the subject of continual study on the part of the management.

The third of the principles of scientific management is the bringing of the science and the scientifically selected and trained workmen together. I say "bringing together" advisedly, because you may develop all the science that you please, and you may scientifically select and train workmen just as much as you please, but unless some man or some men bring the science and the workman together all your labor will be lost. We are all of us so constituted that about three-fourths of the time we will work according to whatever method suits us best; that is, we will practice the science or we will not practice it; we will do our work in accordance with the laws of the science or in our own old way, just as we see fit unless some one is there to see that we do it in accordance with the principles of the science. Therefore I use advisedly the words "bringing the science and the workman together." It is unfortunate, however, that this word "bringing" has rather a disagreeable sound, a rather forceful sound; and, in a way, when it is first heard it puts one out of touch with what we have come to look upon as the modern tendency. The time for using the word "bringing," with a sense of forcing, in relation to most matters, has gone by; but I think that I may soften this word down in its use in this particular case by saying that nine-tenths of the trouble with

those of us who have been engaged in helping people to change from the older type of management to the new management—that is, to scientific management—that nine-tenths of our trouble has been to "bring" those on the management's side to do their fair share of the work and only one-tenth of our trouble has come on the workman's side. Invariably we find very great opposition on the part of those on the management's side to do their new duties and comparatively little opposition on the part of the workmen to cooperate in doing their new duties. So that the word "bringing" applies much more forcefully to those on the management's side than to those on the workman's side.

The fourth of the principles of scientific management is perhaps the most difficult of all of the four principles of scientific management for the average man to understand. It consists of an almost equal division of the actual work of the establishment between the workmen, on the one hand, and the management, on the other hand. That is, the work which under the old type of management practically all was done by the workman, under the new is divided into two great divisions, and one of these divisions is deliberately handed over to those on the management's side. This new division of work, this new share of the work assumed by those on the management's side, is so great that you will, I think, be able to understand it better in a numerical way when I tell you that in a machine shop, which, for instance, is doing an intricate business—I do not refer to a manufacturing company, but, rather, to an engineering company; that is, a machine shop which builds a variety of machines and is not engaged in manufacturing them, but, rather, in constructing them—will have one man on the management's side to every three workmen; that is, this immense share of the work—~~one-third~~—has been deliberately taken out of the workman's hands and handed over to those on the management's side. And it is due to this actual sharing of the work between the two sides more than to any other one element that there has never (until this last summer) been a single strike under scientific management. In a machine

shop, again, under this new type of management there is hardly a single act or piece of work done by any workman in the shop which is not preceded and followed by some act on the part of one of the men in the management. All day long every workman's acts are dovetailed in between corresponding acts of the management. First, the workman does something, and then a man on the management's side does something; then the man on the management's side does something, and then the workman does something; and under this intimate, close, personal cooperation between the two sides it becomes practically impossible to have a serious quarrel.

Of course I do not wish to be understood that there are never any quarrels under scientific management. There are some, but they are the very great exception, not the rule. And it is perfectly evident that while the workmen are learning to work under this new system, and while the management is learning to work under this new system, while they are both learning, each side to cooperate in this intimate way with the other, there is plenty of chance for disagreement and for quarrels and misunderstandings, but after both sides realize that it is utterly impossible to turn out the work of the establishment at the proper rate of speed and have it correct without this intimate, personal cooperation, when both sides realize that it is utterly impossible for either one to be successful without the intimate, brotherly cooperation of the other, the friction, the disagreements, and quarrels are reduced to a minimum. So I think that scientific management can be justly and truthfully characterized as management in which harmony is the rule rather than discord.

There is one illustration of the application of the principles of scientific management with which all of us are familiar and with which most of us have been familiar since we were small boys, and I think this instance represents one of the best illustrations of the application of the principles of scientific management. I refer to the management of a first-class American baseball team. In such a team you will find almost all of the elements of scientific management.